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**Multivitamins/multiminerals in Switzerland: a
first assessment**

**The fallacy of slimming products: a case analysis
in Switzerland**

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The fallacy of slimming product: a case analysis in Switzerland, N.Droz*, P. Marques-Vidal, (Lausanne, Suisse) – Poster

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Multivitamins/multiminerals in Switzerland: a first assessment

Abstract

Purpose: To assess the composition and compliance with legislation of multivitamin/multiminerals (MVM) in Switzerland.

Methods: Information on the composition of vitamin/minerals supplements was obtained from the Swiss drug compendium, the Internet, pharmacies, parapharmacies and supermarkets. MVM was defined as the presence of at least 5 vitamins and/or minerals.

Results: 95 MVM were considered. The most frequent vitamins were B₆ (73.7%), C (71.6%), B₂ (69.5%) and B₁ (67.4%); the least frequent were K (17.9%), biotin (51.6%), pantothen (55.8%) and E (56.8%). Around half of MVMs provided >150% of the ADI for vitamins. The most frequent minerals were zinc (66.3%), calcium (55.8%), magnesium (54.7%) and copper (48.4%), and the least frequent were fluoride (3.2%), phosphorous (17.9%) and chrome (22.1%). Only 25% of MVMs contained iodine. More than two thirds of MVMs provided between 15 and 150% of the ADI for minerals, and few MVMs provided >150% of the ADI. While few MVMs provided <15% of the ADI for vitamins, a considerable fraction did so for minerals (32.7% for magnesium, 26.1% for copper and 22.6% for calcium).

Conclusion: There is a great variability regarding the composition and amount of MVMs in Switzerland. Several MVM do not comply with the Swiss legislation.

Introduction

Consumption of multivitamin / mineral (MVM) supplements is popular in the general population [1, 2], leading to a significant part of the overall dietary intake [3, 4]. In the European Union (EU), MVM represent half of the EU food supplement market, which has been estimated at around five billion Euros in 2005 [5]. MVM can contain a variable number of vitamins and minerals, the characteristics and amounts ranges of which are regulated [6, 7]. Nevertheless, this legislation is relatively supple, as no definition of MVM is currently available, and the amounts of vitamins or minerals allowed per unit (pill, capsule...) can vary considerably. This leads to a large variety of MVM supplements available, which differ in the number and amount of vitamins and minerals included. Hence, shifting from one MVM supplement to another might lead to changes in the number and amount of vitamins and minerals consumed. Finally, from our own experience, many subjects are unable to remember the brand of the MVM they consume and many also believe that all MVMs are equivalent.

In this study, we aimed at characterizing the composition and compliance with Swiss legislation of the MVM available in Switzerland.

Methods

The composition of vitamin/mineral supplements available in Switzerland was obtained from several sources: the Swiss drug compendium, the Internet, pharmacies, parapharmacies and supermarkets. Whenever necessary, further information was gathered by contacting the producer. The geographical search area was restricted to the Vaud canton, but all information in French, German or Italian (official languages in Switzerland) was collected. The following inclusion criteria were used: 1) containing at least one vitamin / mineral; 2) taken orally and 3) amount of vitamin / mineral indicated. The second criterion led to the exclusion of intravenous or intramuscular preparations, while last criterion precluded the collection of supplements

such as “vitamin-rich” herbal extracts or juices, for which no objective information on vitamin content was available.

For each vitamin/mineral supplement retained, the composition and the maximal recommended posology (if available) were collected. When the recommended posology was missing, the value of one unit/day was used. The percentage of the recommended dietary allowance (RDA) provided by the maximum posology was also calculated and categorized as follows: <15%, 15-150% and >150%. The RDAs were derived from the Swiss legislation [6]. According to the Swiss legislation, if a MVM contains a vitamin (mineral) in amounts lower than 15% or the RDA, this vitamin (mineral) should not be indicated on the label [6]. No institutional ethical committee approval was needed as this study only focused on MVM.

Statistical analyses were conducted using Stata v.12 (Stata corp, College Station, TX, USA). Descriptive results were presented as number (percentage) or median [interquartile range]. As there is no common definition for a multivitamin preparation, two analyses were performed: the first considered all supplements with at least 5 vitamins and/or minerals, and the second included only supplements with at least 10 vitamins and/or minerals.

Results

Of the 254 vitamin/mineral supplements initially retained, 95 (37%) had at least 5 components and were considered as MVM. Their composition is summarized in **table 1**. The most frequent vitamins were B₆, C, B₂ and B₁, while vitamins K and A were present in less than half of the MVMs. The most frequent minerals were zinc, calcium, magnesium and copper, while iodine, fluoride, phosphorous, potassium and chrome were present in less than one quarter of the MVMs. When the maximum recommend posology was considered, almost half of the resulting intakes for vitamins were over 150% of the RDA, although this percentage was lower for niacin and vitamin K (table 1). Most of the resulting intakes for minerals were between 15%

and 150% of the RDA, although higher percentages of MVMs below 15% of RDA were noted for phosphorous, magnesium, copper and calcium (**table 1**).

Restricting the analysis to MVM with at least 10 ingredients decreased the number of supplements to 46 (18%) and led to a slight decrease of the intakes representing more than 150% of the RDA for vitamins, while no considerable change was found for minerals (**table 2**).

Table 1. Characteristics of, and vitamin/mineral provision by multivitamin-multimineral supplements available in Switzerland.

	% of MVM containing	Amount § Median [IQR]	% RDA § Median [IQR]	<15% RDA	15-150% RDA	>150% RDA
Vitamins						
Vitamin A (IE)	34 (35.8)	2667 [1047 - 3500]	100 [32.5 - 131.2]	4 (11.8)	30 (88.2)	-
Vitamin B ₁ (mg)	64 (67.4)	2.3 [1.4 - 4.5]	205 [127 - 409]	-	30 (46.9)	34 (53.1)
Vitamin B ₁₂ (µg)	58 (61.0)	4.5 [2.5 - 10]	180 [100 - 400]	-	26 (44.8)	32 (55.2)
Vitamin B ₂ (mg)	66 (69.5)	2.2 [1.6 - 4.8]	157 [114 - 343]	-	33 (50.0)	33 (50.0)
Vitamin B ₆ (mg)	70 (73.7)	3 [2 - 6]	214 [143 - 429]	-	27 (38.6)	43 (61.4)
Vitamin C (mg)	68 (71.6)	100 [60 - 240]	125 [75 - 300]	2 (2.9)	37 (54.3)	29 (42.7)
Vitamin D (µg)	57 (60.0)	10 [5 - 15]	200 [100 - 300]	-	25 (43.9)	32 (56.1)
Vitamin E (mg)	54 (56.8)	17.5 [10 - 50]	146 [83 - 417]	-	27 (50.0)	27 (50.0)
Vitamin K (µg)	17 (17.9)	50 [27.5 - 100]	67 [37 - 133]	-	14 (82.3)	3 (17.7)
Niacin (mg)	61 (64.2)	20 [17 - 47]	125 [106 - 294]	-	37 (60.7)	24 (39.3)
Pantothenic acid (mg)	53 (55.8)	16.2 [6 - 23.5]	269 [100 - 392]	-	18 (34.0)	35 (66.0)
Folic acid (µg)	56 (59.0)	400 [200 - 600]	200 [100 - 300]	1 (1.8)	19 (33.9)	36 (64.3)
Biotin (µg)	49 (51.6)	150 [47.5 - 200]	300 [95 - 400]	1 (2.0)	20 (40.8)	28 (57.2)
Minerals						
Calcium (mg)	53 (55.8)	200 [122.5 - 500]	25 [15 - 63]	12 (22.6)	37 (69.8)	4 (7.6)
Magnesium (mg)	52 (54.7)	100 [50 - 187.5]	27 [13 - 50]	17 (32.7)	33 (63.5)	2 (3.9)
Iron (mg)	39 (41.1)	10 [5.6 - 14]	71 [40 - 100]	4 (10.3)	30 (76.9)	5 (12.8)
Copper (µg)	46 (48.4)	950 [115 - 1000]	95 [12 - 100]	12 (26.1)	27 (58.7)	7 (15.2)

Iodine (µg)	23 (24.2)	150 [75 - 150]	100 [50 - 100]	1 (4.3)	20 (87.0)	2 (8.7)
Zinc (mg)	63 (66.3)	10 [7.5 - 15]	100 [75 - 150]	3 (4.8)	38 (60.3)	22 (34.9)
Manganese (mg)	45 (47.4)	2.0 [1.0 - 3.3]	100 [50 - 165]	3 (6.7)	29 (64.4)	13 (28.9)
Selenium (µg)	38 (40.0)	50 [27.3 - 70]	91 [50 - 127]	1 (2.6)	28 (73.7)	9 (23.7)
Chrome (µg)	21 (22.1)	35 [25 - 50]	88 [63 - 125]	-	18 (85.7)	3 (14.3)
Molybdenum (µg)	22 (23.2)	50 [45 - 100]	100 [90 - 200]	-	15 (68.2)	7 (31.8)
Fluoride (mg)	3 (3.2)	1.5 [0.4 - 3.5]				
Potassium (mg)	21 (22.1)	80 [28 - 190]	4 [1 - 10]	16 (76.2)	4 (19.1)	1 (4.8)
Phosphorous (mg)	17 (17.9)	125 [20 - 142]	18 [3 - 20]	8 (47.1)	9 (52.9)	-

For components containing at least 5 vitamins or minerals (N=95). IQR, interquartile range; MVM, multivitamin/multimineral; RDA, recommended dietary allowance according to the Swiss legislation. Results are expressed as number of products (percentage) or as median [interquartile range]. § for maximum recommended posology; when the posology was not available, a value of 1unit/day was considered. No RDA available for fluoride

Table 2: Characteristics of, and vitamin/mineral provision by multivitamin-multimineral supplements available in Switzerland.

	% of MVM containing	Amount § Median [IQR]	% RDA § Median [IQR]	<15% RDA	15-150% RDA	>150% RDA
Vitamins						
Vitamin A (IE)	29 (63.0)	2667 [1739 - 3550]	100 [50 - 131]	1 (3.5)	28 (96.6)	-
Vitamin B ₁ (mg)	44 (95.7)	1.5 [1.4 - 4.2]	136 [127 - 377]	-	27 (61.4)	17 (38.6)
Vitamin B ₁₂ (µg)	42 (91.3)	3.5 [2.0 - 8.1]	140 [78 - 325]	-	21 (50.0)	21 (50.0)
Vitamin B ₂ (mg)	44 (95.7)	1.7 [1.5 - 4.1]	121 [104 - 293]	-	28 (63.6)	16 (36.4)
Vitamin B ₆ (mg)	46 (100.0)	2.6 [2.0 - 5.2]	186 [143 - 368]	-	22 (47.8)	24 (52.2)
Vitamin C (mg)	44 (95.7)	90 [60 - 180]	112.5 [75 - 225]	-	28 (63.6)	16 (36.4)
Vitamin D (µg)	39 (84.8)	5.5 [5.0 - 12.5]	110 [100 - 250]	-	20 (51.3)	19 (48.7)
Vitamin E (mg)	41 (89.1)	15 [10.0 - 36.7]	125 [83 - 305]	-	22 (53.7)	19 (46.3)
Vitamin K (µg)	15 (32.6)	50 [25 - 75]	67 [33 - 100]	-	14 (93.3)	1 (6.7)
Niacin (mg)	44 (95.7)	18 [16 - 30]	113 [100 - 188]	-	31 (70.5)	13 (29.6)
Pantothenic acid (mg)	38 (82.6)	10 [6 - 20]	167 [100 - 333]	-	16 (42.1)	22 (57.9)
Folic acid (µg)	41 (89.1)	400 [200 - 407]	200 [100 - 204]	-	14 (34.2)	27 (65.9)
Biotin (µg)	39 (84.8)	75 [40 - 200]	150 [80 - 400]	-	18 (46.2)	21 (53.9)
Minerals						
Calcium (mg)	33 (71.4)	180.6 [100 - 239]	23 [13 - 30]	9 (27.3)	24 (72.7)	-
Magnesium (mg)	35 (76.1)	60 [40 - 100]	16 [11 - 27]	17 (48.6)	18 (51.4)	-
Iron (mg)	30 (65.2)	10 [7 - 15]	71 [50 - 107]	2 (6.7)	24 (80.0)	4 (13.3)
Copper (µg)	30 (65.2)	900 [367.5 - 1000]	90 [37 - 100]	7 (23.3)	20 (66.7)	3 (10.0)

Iodine (µg)	22 (47.8)	150 [71.3 - 150]	100 [48 - 100]	1 (4.6)	19 (86.4)	2 (9.1)
Zinc (mg)	41 (89.1)	10 [6.8 - 15]	100 [68 - 150]	3 (7.3)	27 (65.9)	11 (26.8)
Manganese (mg)	31 (67.4)	2 [1 - 3]	100 [50 - 150]	2 (6.5)	21 (67.7)	8 (25.8)
Selenium (µg)	25 (54.4)	50 [26.5 - 57.5]	91 [48 - 105]	1 (4.0)	19 (76.0)	5 (20.0)
Chrome (µg)	19 (41.3)	35 [25 - 50]	88 [63 - 125]	-	16 (84.2)	3 (15.8)
Molybdenum (µg)	21 (45.7)	50 [45 - 100]	100 [90 - 200]	-	14 (66.7)	7 (33.3)
Fluoride (mg)	3 (6.5)	1.5 [0.4 - 3.5]				
Potassium (mg)	12 (26.1)	80 [22 - 80]	4 [1 - 4]	11 (91.7)	1 (8.3)	-
Phosphorous (mg)	15 (32.6)	50 [20 - 133.3]	7 [3 - 19]	8 (53.3)	7 (46.7)	-

For components containing at least 10 vitamins or minerals (N=46). IQR, interquartile range; MVM, multivitamin/multimineral; RDA, recommended dietary allowance according to the Swiss legislation. Results are expressed as number of products (percentage) or as median [interquartile range]. § for maximum recommended posology; when the posology was not available, a value of 1/day was considered.

Discussion

To our knowledge, this is the first study in Switzerland and in Europe to assess the composition and compliance to legislation of MVM. Our results show that the composition of MVMs varies considerably according to the definition applied. For instance, if a loose definition is used (at least 5 vitamins or minerals), a sizable fraction of the MVMs lacks specific vitamins or minerals; using a more restrictive criterion (at least 10 vitamins or minerals) leads to products that contain mostly all vitamins and minerals of interest. Hence, we propose that MVMs be defined as components that contain at least 10 different vitamins or minerals, as a first step for standardization and comparison between studies. Conversely, the amount of vitamins and minerals per unit varied considerably between MVMs. This precludes the possibility of devising a “standard MVM”, the composition of which could be used when no information is available regarding the brand of the product consumed. Thus, and unless new legislations lead to a narrowing of the amounts of vitamins and minerals per unit, the use of a “standard MVM” cannot be recommended.

Amount of vitamins and minerals provided by the MVMs

Slightly more than half of all MVMs provided vitamins in amounts exceeding 150% of the RDA, while the percentage of MVMs providing minerals exceeding the 150% threshold was considerably lower. Interestingly, MVMs with at least 10 vitamins and minerals appear to contain lower doses than MVMs with at least 5 vitamins or minerals. The reasons for such a discrepancy are unclear and can only be speculated. Hydrosoluble vitamins consumed in excess can be excreted via the liver, while no such mechanism is available for some minerals; hence, the amount of minerals might be reduced for safety reasons. MVMs with a large number of vitamins and minerals might be more expensive, thus tempting the manufacturers to reduce the amount of vitamins and minerals present per unit. Still, further research is needed to clarify this issue.

The main iodine source in Switzerland is iodized table salt, which has proved a successful preventive measure against goiter and iodine deficiency [8, 9]. Still, recommendations towards lower salt intake [10] and the use of fashionable, exotic (and non-iodized) salt by the Swiss population might actually lead to an increase in iodine deficiency [11]. Somewhat unexpectedly, the number of MVMs containing iodine was rather low, while it could be of benefit for a fraction of the Swiss population. Indeed, MVM consumers tend to present a healthier dietary pattern and to be more respondent to dietary recommendations, including salt reduction. Hence, in these subjects, the lower iodine intake due to lower salt intake could be compensated by MVMs.

The presence of vitamin K (mainly indicated as prevention against arthritis) in one out of six MVMs (one third if the 10 threshold is used) stresses the need for a warning. Indeed, shifting from one MVM with vitamin K to another without (and vice-versa) might have serious consequences in patients on anticoagulants [12], namely in MVMs whose content of vitamin K exceeds 150% of the RDA. Finally, very few MVMs contained fluoride, probably in order to prevent any adverse effect of excessive consumption [13].

Several MVMs indicated in their label vitamins or minerals in amounts lower than 15% of RDA, a finding in disagreement with Swiss legislations [6]. Interestingly, inadequate labelling concerned calcium, magnesium and copper, while very few vitamins had values below the 15% level. Marketing issues might explain this finding, as MVMs with calcium and magnesium indicated in the label might be more appealing to the elderly (as prevention for osteoporosis) and to subjects with anxiety [14], respectively. Still, further studies are needed to better assess this point.

Study limitations

This study has several limitations that should be accounted for. First, the collection of vitamin and mineral supplements was limited to the canton of Vaud, and it is possible that other products are available in other cantons. Still, all vitamin supplements from the Swiss drug

compendium and from national producers and sellers were collected, which might limit the number of supplements missed. Second, it was not possible to use a standard definition of MVM, so the proposed ones might be questionable. Nevertheless, they are a first step towards a minimal standardisation of the definition of MVM, thus allowing further comparisons between studies. Third, it was not possible to validate the vitamin and mineral content of the MVM, due to the lack of funding. It will be of interest that the Swiss agency for therapeutic products performs such controls, at least in a limited sample of MVMs. Fourth, some MVMs had no posology indicated, and a maximal posology of one unit per day had to be considered. Still, the one per day posology is the most frequent for MVMs. Finally, we used the RDAs indicated in the Swiss legislation [6] instead of the RDAs suggested by the Swiss Society of Nutrition (SSN) [15]. As the values differ (**table 3**), the results would be different if the RDAs of the SSN were used. Still, as we aimed at assessing compliance with national legislations, we consider that the choice of the RDAs from the legislation was appropriate.

Conclusion

Multivitamin/multimineral supplements available in Switzerland vary considerably regarding their composition and amount of vitamins and minerals. Several MVM do not comply with Swiss legislations, which calls for implementation measures.

Table 3. Comparison of the recommended dietary allowances for adults from the Swiss legislation and from the Swiss Society of Nutrition

	Swiss legislation	Swiss Society of Nutrition
Vitamins		
Vitamin A (µg/day)	800	800-1000
Vitamin B ₁ (mg/day)	1.1	1.0-1.2
Vitamin B ₁₂ (µg/day)	2.5	3.0
Vitamin B ₂ (mg/day)	1.4	1.2-1.4
Vitamin B ₆ (mg/day)	1.4	1.2-1.5
Vitamin C (mg/day)	80	100
Vitamin D (µg/day)	5	20
Vitamin E (mg/day)	12	12-14
Vitamin K (µg/day)	75	60-70
Niacin (mg/day)	16	13-16
Pantothenic acid (mg/day)	6	6
Folic acid (µg/day)	200	400
Biotin (µg/day)	50	30-60
Minerals		
Calcium (mg/day)	800	1000
Magnesium (mg/day)	375	300-350
Iron (mg/day)	14	10-15
Copper (µg/day)	100	100-150
Iodine (µg/day)	150	150
Zinc (mg/day)	10	7-10
Manganese (mg/day)	2	2-5
Selenium (µg/day)	55	30-70
Chrome (µg/day)	40	30-100
Molybdenum (µg/day)	50	50-100
Fluoride (mg/day)	-	3.1-3.8
Potassium (mg/day)	2000	2000
Phosphorous (mg/day)	700	700

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The fallacy of slimming products: a case analysis in Switzerland

Abstract

Objectives: To assess weight loss claims of slimming products available in Switzerland

Methods: Between May 2008 and February 2013, 31 advertisements for 13 different slimming products from a single seller were collected and their content analyzed.

Results: Total weight loss claims ranged between 7 and 31 kg, with an estimated daily weight loss ranging between 300g and 1kg. Eighty-four percent of the advertisements included the photograph of a woman, 61% showed a picture of a person before and after using the product, and 51% claimed that the product had improved marital relationships. The terms “natural”, “miracle/extraordinary” and “scientific” were present in 92%, 77%, and 31% of the advertisements, respectively. Cost per package was very similar for all 13 products (range: 49 to 59 CHF – 52 to 63 US\$, with 8 products costing the same amount) and no correlation was found between cost of the product and weight loss claims. No differences were found for weight loss claims according to presence or absence of a picture or of the terms “natural”, “miracle/extraordinary” and “scientific”. Supposing that 1% of readers bought one product advertised, the yearly revenues ranged between 2.35 and 6.37 million CHF (2.52 and 6.83 million US\$).

Conclusion: In Switzerland, advertisements for slimming products use positive and reassuring terms to attract consumers, which are lured by unreachable, false promises of rapid and easy weight loss. The revenues appear to be considerable. Adequate implementation of the regulation of such products is urgently needed.

Keywords: slimming products; advertisement; Switzerland

Introduction

Obesity is increasing worldwide. As a corollary, the market of slimming or low calorie products has evolved at a similar if not a higher pace. It has been estimated that the global weight management market will attain US\$586 billion in 2014 ¹, a value higher than the GNP of Greece ². In the US, it has been estimated that 15.2% of adults had ever used a weight-loss supplement ³. In a competitive market and in the absence of strict regulations, unethical marketing strategies are put forward to sell slimming products whose properties have not been scientifically proven ⁴. Indeed, many marketing strategies capitalize into concepts such as quick results, obtained at little if no change in lifestyle, in almost complete disagreement with the scientific literature. Overweight or obese subjects are lured into buying products of little if no proven efficacy, with potential effects in the self-esteem (incapacity of achieving the promised weight losses) and anxiety of these subjects ⁵. This leads to a spiral of disappointment/increased expectations/action (buying a “new” slimming product) and again disappointment, which could significantly decrease further adherence to adequate weight loss strategies ⁶. Indeed, overweight or obese subjects continuously submitted to claims of quick and easy weight losses by these marketing strategies will be less prone in adhering to weight loss strategies that must be applied for a long time and that rely on lifestyle changes ⁷. Still, to the best of our knowledge, little objective data has been published on the marketing strategies of slimming products with little if no proven efficacy.

Thus, we performed a qualitative analysis of the weight loss claims of several slimming products available in Switzerland. We conducted the study by analyzing the publicities for these products as they appeared in the most read Swiss magazine.

Methods

Between May 2008 and February 2013, 31 advertisements for 13 different slimming products appearing in the largest Swiss magazine were analyzed. This magazine appears every two weeks and claims over 1.2 million readers per issue, corresponding to almost one fifth of the

Swiss adult population. The magazine is issued in the three official languages of Switzerland (German, French and Italian), but only the advertisements in the French-speaking issues were collected. A further analysis of the other issues showed that the advertisements actually appeared in all language editions, and that the text was similar (not show).

Data extraction

For each advertisement, we conducted a text analysis searching for the words related to evidence based data (“science / scientific”; “trial / study”) or not (“miracle / wonderful / marvellous”; “secret / hidden”). The characteristics of the weight loss were categorized by searching words such as “quick”, “easy”, “no change” (in lifestyle) and by collecting the promised weight loss (number of kg and duration of weight loss period). The characteristics of the product were categorized by searching words such as “natural” or “bio” and by assessing, whenever possible, its origin (plant extract or other). Personal and social benefits of the weight loss were evaluated by searching situations such as recovering self-esteem, recovering the love from family or obtaining a job position. Other data, such as the presence of a before/after picture, the gender of the person in the picture (male/female), the presence of a promotional gift were also collected.

Market value

It was not possible to assess directly the true returns for the selling of these products; hence, we calculated the overall yearly costs for their advertisements based on the advertising costs for 2012 as indicated by the magazine. As publicity usually leads to higher returns than the initial costs of advertising, it was expected that the true sales would at least exceed the expenses in publicity. A second estimation was performed, by collecting the cost of the product and supposing that 1% of the readers of the magazine would buy one unit of the product for each advertisement.

As this information is freely available, no specific authorizations from commercial firms or from Ethics Committees were needed.

Statistical analyses

Data was inserted in an Excel (Microsoft, Redmond, USA) spreadsheet and further analyzed using Stata v. 12.0 (Stata corp, College Station, TX, USA). Descriptive results were expressed as number of advertisements and (percentage) or as range. Comparisons were performed using Fisher's exact test for qualitative data and Kruskal-Wallis nonparametric test for quantitative data.

Results

Between 2008 and 2012, thirty-one advertisements for 13 different slimming products appeared in the French issue of the magazine. As the advertisements for a given product appeared several times, the analysis was based on the 13 different products.

The terms "natural", "miracle/extraordinary" and "scientific" were present in 92%, 77%, and 31% of the products, respectively. The promises of weight loss ranged between 7 and 31 kg within a period of time ranging between 7 days to 7 weeks. The estimated daily weight loss ranged between 300g and 1 kg. Almost all (94%) of the advertisements targeted women by including the photograph of a woman; 61% showed a picture of a person before and after using the product, and 51% claimed that the product had improved marital relationships. Free gifts were provided to buyers for 69% of the products.

Cost was very similar for all 13 products (range: 49 to 59 CHF - 52 to 63 US\$, with 8 products costing the same amount) and no correlation was found between cost of the product and weight loss claims (spearman correlation between minimal cost and total weight loss: -0.41, $p=0.16$; between minimal cost and weight loss rate: 0.28, $p=0.41$). No differences were found for weight loss claims according to presence or absence of a picture or of the terms "natural", "miracle/extraordinary" and "scientific" (all $p>0.05$, not shown).

The yearly costs for advertising such products ranged between 56,000 and 126,000 CHF (60,000 to 135,000 US\$) for French-speaking Switzerland, and between 190,000 and 428,000 CHF (204,000 to 459,000 US\$) for whole Switzerland. Considering that 1% of the 1.2 million readers actually bought one unit of the product, the estimated annual revenues ranged between 2.35 and 6.37 million CHF (2.52 and 6.83 million US\$).

Discussion

There are few if any studies on the content of advertisements for slimming products marketed in Switzerland or in Europe. A similar study conducted in the early nineties in France concluded that most advertisements for slimming products do not give any indication on the composition of products or on the nature of the proposed methods, and that the selling arguments are most often fallacious ⁴. Indeed, the arguments of the advertisements for slimming products in 1992 differed little from the ones collected in our study, suggesting that the general public is still receptive to them. Further, the weight loss claims are several orders of magnitude higher than achieved by adequately conducted randomized controlled trials ^{8, 9}, which raises ethical ¹⁰ and even legal issues ¹¹, as they lure vulnerable obese people into falsely believing that weight loss can be easily achieved without any change in lifestyle.

Interestingly, the EU (non-Swiss) legislation on slimming products relates to foods that replace the whole or part of the total daily diet ¹², while most if not all products analysed here were considered as supplements, hence not encompassed *strictu sensu* by the legislation. Our results thus suggest that some companies consistently exploit legislative voids to use fallacious arguments which would be forbidden, had their products be commercialized as dietary replacements. More worryingly, Switzerland has a specific regulation regarding the slimming properties of dietary products (ODAI0Us), which prohibits any kind of endorsement for foodstuffs as a weight loss product, or suggesting that it has similar properties (article 10) ¹³. The fact that several companies manage to promote and sell such kind of products in

Switzerland further stresses the need of adequately enforcement of the existing regulations, rather the issuing of new ones.

This study has some limits. First, we only searched a single magazine, and it might not be representative of the other magazines read by the Swiss general population. Still, this is by far the most read magazine in Switzerland, and a further search on other public magazines (including one distributed in pharmacies at 400,000 copies/month) showed the same type of advertisements. Hence, we do believe that this sort of advertisement is rather common in the Swiss public press. Second, we could only provide a rough estimate of the potential income generated by such products. Although the cost/effectiveness and impact of such advertisements on the knowledge on weight reduction by the general population is unknown, it is most certainly higher than the impact of the preventive campaigns on healthy body weight conducted in Switzerland. For instance, in 2011, 14.8 million CHF (15.9 million US\$) were invested in healthy body weight promotion campaigns, which impacted 130,000 children and adolescents and an unknown number of adults ¹⁴. This is roughly one tenth the number of subjects and 40 times more expensive than what was achieved *via* advertisements in the Swiss magazine studied, and even lower (resp. higher) if other magazines were taken into account. Our results thus suggest that, in Switzerland, the marketing of (ineffective) slimming products is considerably more cost-effective than healthy body weight promotion. Our results also suggest the revenues are considerable, even when a conservative estimate that only 1% of the readers (compared to much higher values observed in the United States ³) buy one single unit of the product.

We conclude that in Switzerland, advertisements for slimming products use positive and reassuring terms to attract consumers, which are lured by unreachable, false promises of rapid and easy weight loss. The revenues obtained are considerable, possibly amounting to several million per year. Adequate implementation of the regulation of such products is urgently needed.

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