

Weight management strategies and food supplement intake among Bulgarian adults: results of a national survey

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Abstract

The number of overweight and obese people has dramatically risen in the last two decades and has become one of the most serious health concerns. This study aimed to assess the use of food supplements as aids in reducing body weight and different approaches for weight management practised by Bulgarian adults.

A cross-sectional, questionnaire-based online survey was conducted between December 2019 and February 2020. A total of 508 adults completed the survey. According to study participants, the Internet was the most used source of weight reduction information (66.9%). One hundred and seventy-two adults (33.9%) have sought weight-loss advice from a personal trainer/fitness instructor, and only 12.6% (n = 64) have consulted with a physician. More than half of the respondents (n = 288, 56.7%) reported food supplement use to maintain weight. The majority of the consumers were female (76.4%, $p < 0.001$) and adults with higher education (89.9%, $p < 0.001$). The main reasons for food supplement intake were individual research on the Internet (43%), advice from a personal trainer/fitness instructor (23.6%), and a recommendation from a healthcare provider (22.2%).

With the increasing rates of overweight and obesity, food supplements are becoming a popular weight-loss approach, which is confirmed by our findings.

Keywords

overweight, obesity, weight reduction, food supplements, lifestyle changes

Introduction

The number of overweight and obese people has dramatically risen in the last three decades and has become one of the most serious health concerns (Tiwari and Balasundaram 2023). Nowadays around 60% of adults in Europe are estimated to be overweight or obese (World Health Organization 2022). According to the World Health Organization (WHO), until recently overweight and obesity were associated mainly with high-income countries,

however, nowadays these conditions are also prevalent in low-income and middle-income countries (World Health Organization 2021). In 2019, 64.3% of men and 46.3% of women (aged 18 years or over) in Bulgaria were considered to be overweight or obese (Eurostat 2021).

Obesity is defined as a multifactorial syndrome associated with increased deposition of adipose tissue in the body (Lin and Li 2021). Excessive food intake and insufficient physical activity are the primary impetus for the development of obesity (Hill et al. 2012). Different individual patterns like

genetic, biological and lifestyle factors (e.g., sedentary lifestyle, alcohol consumption, smoking, etc.), can contribute to developing excessive body weight (Teng et al. 2020).

Obesity and overweight require special attention. Besides the aesthetic aspect of being overweight and obese, these conditions are long-term risk factors for the development of metabolic syndrome, type 2 diabetes, hepatic steatosis, depression, sleep apnea, infertility, increased carcinogenesis, and ultimately impaired quality of life (The GBD 2015 Obesity Collaborators 2017; Lin and Li 2021; Milano et al. 2022). Overweight and obese people are often stigmatized by society, rarely seek help from a healthcare provider or are referred to one after years of independent attempts to reduce weight.

Current strategies for weight control include lifestyle modifications, pharmacotherapy, food supplement use, management of calorie intake, and bariatric surgery (Batsis et al. 2021).

Different dietary approaches and food supplements are the most accessible methods for weight reduction but are not always the most appropriate. Usually, most people start their own weight-loss programs by including food supplements in the hope that they will help them achieve weight reduction more easily (National Institutes of Health Office of Dietary Supplements 2021). This approach does not always bring the expected results, but at the same time, it hides some risks (Batsis et al. 2021). For example, a variety of food supplements with different trade names may contain the same ingredients, and their simultaneous use could lead to an elevation of their concentration in the body (Wierzejska 2021). There are plenty of different food supplements in the segment “weight loss”. Usually, these products include amino acids, plant and herbal extracts, minerals, vitamins, and combinations of the above-mentioned. (Bonetti et al. 2022). The most commonly used plants and herbal extracts in food supplements for weight loss are green tea (*Camellia sinensis*), green coffee bean (*Coffea arabica*, *Coffea robusta*), *Garcinia cambogia* (hydroxycitric acid), bitter orange (*Citrus aurantium* L.), African mango (*Irvingia gabonensis*), etc. (National Institutes of Health Office of Dietary Supplements 2021). The labels of most food supplements often do not show the caffeine content, because of the specifics of the legislation for such products (Kole and Barnhill 2013).

Most consumers do not know that the legislation on food supplements almost all over the world does not require obligatory quality control (Lam et al. 2022). The absence of quality control has caused the appearance of many products with poor quality worldwide. According to Regulation (EC) No 178/2002, food supplements are considered as foodstuffs and the responsibility for their safety lies with the manufacturer, importer, supplier, or distributor who places the food supplement on the market (EFSA 2018). Recent studies announced that many food supplements contain undeclared substances, which are harmful to human health and are especially dangerous for people with chronic conditions like hypertension (Costa et al. 2019; Konsz 2021; White 2022). Florence van Hunsel et al. (2015)

reported that they analyzed fifty “natural” weight-loss products. Undeclared compounds such as sibutramine and analogues were identified in 24 of these food supplements (Hunsel et al. 2015). The presence of undeclared substances in food supplements like sibutramine exposes consumers to serious risks. In 2010, the European Medicines Agency recommended the suspension of marketing authorizations for sibutramine, because of an increased risk of cardiovascular events (European Medicines Agency 2018).

A recent systematic review shows that there is no high-quality scientific evidence of the efficacy of food supplements in weight reduction (Batsis et al. 2021). Despite the lack of evidence to support their benefits in maintaining a moderate weight, the consumption of food supplements is rising. Results of a major consumer survey conducted in 14 EU countries showed that 88% of respondents have used food supplements at some point in their lives, and 93% of this group had done so in the previous 12 months. According to the survey, weight management was one of the top 20 reasons for taking food supplements (IPSOS 2022). The higher demand may be associated with advertisements of food supplements and claims of effectiveness and safety that they include (Lubowiecki-Vikuk et al. 2019).

Food supplements are widely available, do not require as much effort as physical activity and diet, and can be a low-cost option in some cases (Lubowiecki-Vikuk et al. 2019; Batsis et al. 2021). Since many food supplements used for weight reduction are available for online purchase on different websites (e.g., specialised food supplement websites or general online marketplaces) this could be one of the preferred methods for consumers to buy them. Other reasons for choosing this purchase method include the privacy element, fast delivery, and convenience for the buyer. Despite these benefits, purchasing food supplements online carries certain risks. For example, even if the online site is situated in the country of purchase, the company may deliver from other countries where legislation and standards regarding food supplements could be less stringent (Farrington et al. 2019).

To the best of our knowledge, the different approaches for weight management practised by Bulgarian adults, as well as the use of food supplements as aids in reducing body weight, have not been evaluated. Therefore, this study aimed to assess the prevalence of food supplement use and weight management attitudes in order to achieve weight goals among Bulgarian adults.

Materials and methods

Study design and setting

This was a cross-sectional, questionnaire-based study. The survey was conducted between December 2019 and February 2020. A self-administered questionnaire was distributed among Bulgarian adults via social media (e.g., Facebook, Twitter) and mobile applications (e.g., Viber, WhatsApp) using the snowball sampling method. The data

was collected through the Google Forms tool. Participation in the study was voluntary and anonymous. To ensure the anonymity of the respondents and to encourage their participation in the survey, identification and contact details were not included. A consent statement was provided at the beginning of the questionnaire, including the aim of the study, the approximate amount of time it would take, a description of the confidentiality of responses, and the voluntary nature of participation. Respondents indicated their consent by agreeing to begin answering the items included in the online questionnaire. According to the national legislation this study did not require ethical approval since it was non-interventional and used anonymized data.

Study tool and population

After reviewing the current literature, we designed the initial version of the questionnaire. Two qualified experts reviewed the draft tool for accuracy, construction, content problems and grammatical mistakes. Based on their feedback, some adjustments were made. Then the questionnaire was piloted with a small group of 10 participants for face and content validity. The final version of the questionnaire comprised twenty items. It was structured in a way to ensure the collection of the information necessary to achieve the aim of the study. The questionnaire starts with general items related to the demographic profile of the respondents and moves on to items specific to the aim of the study. The survey included questions about respondents' demographics (gender, age, education, employment status, etc.); weight loss approaches; use of food supplements for weight loss, including information regarding reasons for intake, sources for purchase and information on whether consumers had ever experienced adverse effects after intake; and overall satisfaction with weight-loss methods. The questionnaire was designed in plain language and included mostly multiple-choice close-ended questions. Satisfaction with weight-loss methods was measured using a 5-point Likert scale (1 = very dissatisfied, 5 = very satisfied).

Inclusion and exclusion criteria

The inclusion criteria were adults, aged 18 years or older, non-pregnant and non-breastfeeding, who made at least one weight-loss attempt in the past or currently trying to lose body weight. Adults unable to write and read the Bulgarian language and those who did not meet the inclusion criteria were excluded from the study.

Data analysis

The collected data was analyzed using the Statistical Package for Social Sciences (SPSS) v. 19 and MS Office Excel for Windows 10. The data were presented as numbers and percentages. Descriptive statistics were applied to participants' characteristics. Pearson's chi-square test was used for the comparison of categorical variables. P-value ≤ 0.05 was considered significant.

Results

A total of 508 Bulgarian adults completed the survey. The socio-demographic and other weight-related characteristics of the respondents are presented in Table 1. Thirty-two per cent (32.3%) of the participants in the study were within the age group 20–29 years. The majority of the respondents were female (64.6%). More than half of the respondents (56.7%) reported the use of food supplements for weight loss. Three hundred and sixty participants (70.9%) described themselves as overweight/obese. Eighty-four adults (16.5%) have used over-the-counter (OTC) and/or prescription medicines for weight reduction. The most reported prescription medicines included orlistat (52.4%), liraglutide (28.6%) and metformin (19%).

Table 1. Characteristics of the respondents.

Characteristics	Number (n)	Percentage (%)
Gender		
Male	180	35.4
Female	328	64.6
Age (years)		
20–29	164	32.3
30–39	136	26.8
40–49	92	18.1
50–59	84	16.5
60+	32	6.3
Education		
High school	152	29.9
University	356	70.1
Employment Status		
Student	92	18.1
Employee	268	52.8
Manager	128	25.2
Retired	20	3.9
Current residence		
Capital city	92	18.1
Regional city	360	70.9
Small town/municipal center	44	8.7
Village	12	2.4
Self-described weight		
Underweight/Slim	28	5.5
Normal	120	23.6
Overweight/obese	360	70.9
Use of OTC/prescription medicine		
Yes	84	16.5
No	424	83.5
Food supplement usage		
Yes	288	56.7
No	220	43.3

Percentages may not total 100 due to rounding.

We found significant differences between the use of food supplements and gender ($p < 0.001$), age groups ($p = 0.033$), current residence ($p = 0.012$) and education ($p < 0.001$) (Table 2).

Table 3 presents the consumers' responses regarding food supplements for weight loss. The main reasons for food supplement intake were individual online research (43%) and advice from a personal trainer/fitness instructor (23.6%), followed by a recommendation from a health-

Table 2. Comparison between demographic characteristics of food supplement users and non-users.

Demographic characteristics	Users (n = 288, 56.7%)	Non-users (n = 220, 43.3%)	p-value
Gender			
Male	68 (23.6)	112 (50.9)	< 0.001
Female	220 (76.4)	108 (49.1)	
Age group (years)			
20–29	80 (27.8)	84 (38.2)	0.033
30–39	88 (30.6)	48 (21.8)	
40–49	68 (23.6)	24 (10.9)	
50–59	28 (9.7)	56 (25.5)	
60+	24 (8.3)	8 (3.6)	
Current residence			
Capital city	76 (26.4)	16 (7.3)	0.012
Regional city	196 (68.1)	164 (74.5)	
Small town/municipal center	12 (4.2)	32 (14.5)	
Village	4 (1.4)	8 (3.6)	
Education			
High school	30 (10.4)	122 (55.5)	< 0.001
University	258 (89.6)	98 (44.5)	
Employment status			
Student	36 (12.5)	56 (25.5)	0.192
Employee	160 (55.6)	108 (49.1)	
Manager	84 (29.2)	44 (20.0)	
Retired	8 (2.8)	12 (5.5)	

All data are presented in *n* (%). Percentages may not total 100 due to rounding.

care provider (22.2%). Forty-eight respondents (16.6%) believe that food supplements are not completely safe.

The food supplements most used by the survey respondents are presented in Fig. 1. Most commonly, participants reported having taken L-carnitine (53.3%), detox supplements such as senna leaf, cascara sagrada bark, aloe vera and psyllium husk (36%), and a combination of fat burners (28%).

Table 3. Consumers' opinion about food supplements for weight loss (n = 288).

	Number (n)	Percentage (%)
Reason for food supplement use		
Advice from a friend	24	8.3
Research on the Internet	124	43.0
Advice from a healthcare provider (pharmacist or physician)	64	22.2
Advice from a personal trainer/fitness instructor	68	23.6
Other	8	2.8
Where do you purchase food supplements most often ?^a		
Pharmacy	152	48.7
Drug store	16	5.1
Supermarket/health food store	48	15.4
Gym	68	21.8
Internet	104	33.3
Do you think weight-loss supplements are completely safe?		
Yes	136	47.2
No	48	16.6
Don't know	104	36.1

^a The question allows respondents to select multiple answers.

Among food supplement users, 13.8% reported experiencing an adverse effect. The most common adverse effects were tachycardia (35%), hypertension (30%) and abdominal discomfort (30%) (Table 4). Food supplements from which consumers have experienced adverse effects include *Garcinia cambogia*, thermogenic fat burners, green coffee and yohimbine-containing supplements.

According to our respondents, the most preferred weight-loss strategies were increased physical activity (70.1%), food supplement intake (56.7%) and hypocaloric diet (41.7%). The most used source of information about weight reduction was the Internet (66.9%). One hundred and seventy-two adults (33.9%) have sought weight-loss advice from a fitness instructor, and only 12.6% have consulted with a physician.

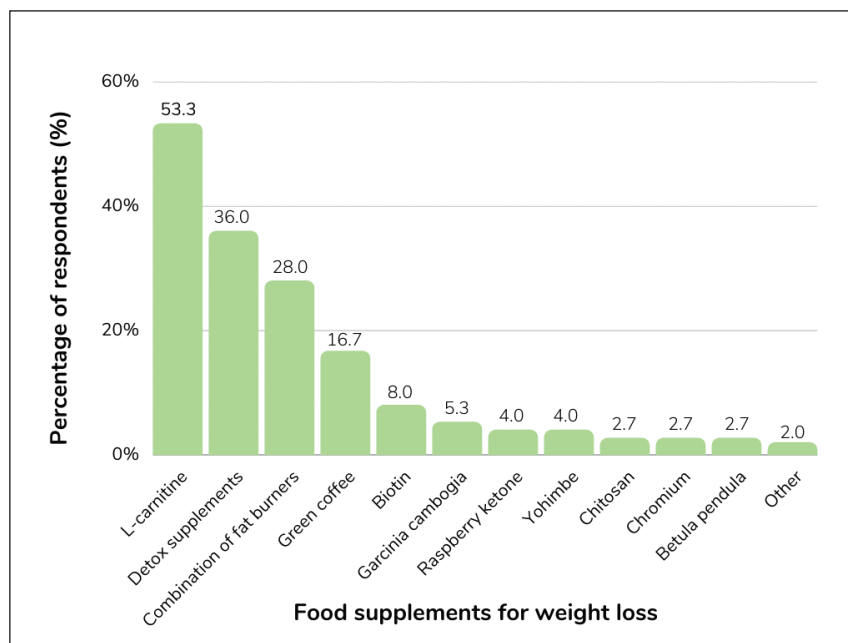
**Figure 1.** Most commonly used food supplements for weight loss according to respondents' answers.

Table 4. Adverse effects reported by food supplement users.

	Number (n)	Percentage (%)
Have you experienced any adverse effects after taking food supplements for weight loss? (n = 288)		
Yes	40	13.8
No	248	86.1
Type of adverse effect (n = 40)^a		
Anxiety/Nervousness	6	15
Headache	8	20
Tachycardia	14	35
Hypertension	12	30
Dry mouth	2	5
Abdominal Discomfort	12	30
Nausea	2	5

^a Multiple response possible.

One hundred and eighty-four (36.2%) of the surveyed adults reported that their weight-loss program lasted more than 3 months. Our respondents believed that increased physical activity contributed the most to losing weight (30.3%), followed by a combination of different weight approaches (29.1%) and a diet (26.9%). More than half (58.3%) of the respondents reported being satisfied/very satisfied with their preferred weight reduction strategy (Table 5).

Table 5. Weight-loss strategies used by respondents and level of satisfaction (n = 508).

	Number (n)	Percentage (%)
Weight-loss strategy^a		
Low-calorie diet	212	41.7
Plant-based diet	28	5.5
Ketogenic diet	64	12.6
Weight management plan	80	15.7
Prescription medicine	84	16.5
Food supplements	288	56.7
Physical activity	356	70.1
Other	24	4.8
Weight-loss advice^a		
Consultation with a physician	64	12.6
Consultation with a pharmacist	76	15.0
Consultation with a personal trainer/fitness instructor	172	33.9
Self-research on the Internet	340	66.9
Advice from a friend	148	29.1
Duration of weight-loss program		
Less than month	48	9.4
More than 1 month	128	25.2
More than 3 months	184	36.2
More than 6 months	68	13.4
One year or more	96	15.8
Most successful weight-loss approaches		
Diet	126	26.9
Increased physical activity	142	30.3
Medication therapy	4	0.9
Food supplement intake	60	12.8
Combination of these approaches	136	29.1
Satisfaction with weight-loss method		
Very satisfied	168	33.1
Satisfied	128	25.2
Neutral	120	23.6
Dissatisfied	48	9.4
Very dissatisfied	44	8.7

^a The question allows respondents to select multiple answers.

Discussion

Our findings suggest that more than half of the surveyed adults (56.7%) take food supplements to achieve weight reduction. Similar results were obtained by Lubowiecki-Vikuk et al. (2019) regarding the rate of weight-loss supplement use among Polish adults (69.5%). The majority of food supplement users in our study were females (76.4%, $p < 0.001$), young adults belonging to age groups 20–29 years and 30–39 years (58.4%), with higher education. Moreover, the surveyed adults who live in urban areas like the capital city and regional centers were more likely to use food supplements (93%). Previous studies have also shown similar trends in the more frequent use of food supplements for maintaining body weight by females and young adults (Blanck et al. 2007; Pillitteri et al. 2008; Lubowiecki-Vikuk et al. 2019). Several studies reported that people with higher educational attainment tend to use food supplements more often (Lee et al. 2017; Mahdavi-Roshan et al. 2021).

According to our results, the Internet and pharmacies are the places where consumers most often purchase food supplements. This is completely understandable, given the fact that food supplements are often advertised in the mass media like the Internet. Findings from a national survey conducted among Bulgarian community pharmacists show that the majority of patients often look for food supplements in pharmacies (Balkanska-Mitkova et al. 2022). According to EU consumers, pharmacy is the most common place to purchase food supplements (IPSOS 2022).

A population-based study conducted in the United States reported that less than one-third (30.2%) of consumers of food supplements for weight loss discuss this use with their physician (Blanck et al. 2007). Our findings confirm these results – only 22.2% of Bulgarian adults have sought advice regarding food supplement use from a health care provider (pharmacist or physician).

In recent years the Internet has become an easily accessible source of health-related information. This is also the case with food supplements used to support weight loss, information on which is widely available online (Ng et al. 2021). The Internet was the main source of information used by our respondents (43.0%) and the primary reason they started taking food supplements to lose weight. A study conducted in 2021 assessed the quality of online health information related to food supplements used for weight reduction (Ng et al. 2021). The authors ascertain that health portals and government websites provided relevant information and less biased assessments of food supplements for weight loss, while commercial websites lacked information surrounding the risks and benefits of food supplements for weight loss and provided more biased assessments. More attention and awareness from consumers and healthcare providers are needed regarding the quality and comprehensiveness of online information related to food supplements for weight loss.

The most commonly used food supplement to support weight reduction according to our results was L-carnitine. Its popularity can be explained by the fact that the majority of participants in our survey were young or middle-aged

adults. According to Nagata et al. (2022), young adulthood and midlife are important periods for interventions to increase and maintain physical activity. L-carnitine has been proposed as a food supplement for weight loss due to its effects on the transport of fatty acids into the mitochondria and the subsequent beta-oxidation (National Institutes of Health Office of Dietary Supplements 2021).

In our survey, we also assessed the participants' opinion about the safety of food supplements. Half of the respondents did not have an opinion on whether food supplements are completely safe. Various studies have shown that not only consumers but also healthcare providers like physicians and pharmacists do not have enough knowledge about the regulation, safety, and effectiveness of food supplements (Ashar 2007; Blanck et al. 2007; Pillitteri et al. 2008; Brunelli et al. 2022). A cross-sectional study from Bulgaria reported that more than half of the outpatient care physicians (58.1%) claimed to have poor or no knowledge of plant-based food supplements (Sokolova et al. 2018).

Plant food supplements are easily accessible to consumers and are claimed to be safe and effective. Nevertheless, in some cases, plant food supplements may cause harm. For example, *Garcinia cambogia*, a popular food supplement used to support weight reduction, was considered unsafe by the Food and Drug Administration (FDA) due to reported cases of liver damage (Andueza et al. 2021). In addition, plant food supplements may interact with the patient's regular medicines or food (Mohamed Ansari and Omar 2017). In our study, some of the consumers of food supplements containing *Garcinia cambogia* reported dry mouth, headache, and gastrointestinal symptoms like an upset stomach. Since our study is based on a self-report questionnaire, the adverse effects described by our participants are not supported by any clinical evidence.

Our results show that physical activity, food supplement intake and low-calorie diet were the most preferred weight management strategies for the surveyed adults. Cross-sectional research conducted among adults in the United Arab Emirates shows a similar trend regarding weight management practices. According to the results from this study, the most popular strategies for weight reduction included increasing physical activity (52.9%), eating less fat (51.1%), consuming fewer calories (43.3%), joining a gym (27.5%), skipping meals (26.1%), and consuming natural herbs and teas (20.7%) (Attlee et al. 2017). Only 5.5% of our respondents have chosen a plant-based diet as a weight-loss approach. This diet is associated with a low-calorie density, is rich in fiber, vitamins and minerals, and contains no cholesterol. Plant foods (minimally processed) have high water content and lower calorie density (Ivanova et al. 2021). It appears that the adoption of a plant-based diet is difficult

for most people although it could provide many benefits, especially for overweight and obese individuals.

Our study has some strengths and limitations. The study sample was relatively big, involving respondents from different geographical areas (urban and rural) across Bulgaria. Another strength is that this is the first study that evaluates the different weight management approaches and the overall prevalence of food supplement intake to facilitate weight loss among Bulgarian adults. In addition, sociodemographic characteristics of participants and their influence on food supplement intake were presented. Despite these strengths, some limitations should be noted. The first limitation is related to a cross-sectional design. Since cross-sectional studies rely on questionnaires as a tool for data collection, reporting might result in being inaccurate as the information presented cannot be verified (report bias). In addition, this type of study does not let any causal relationships be assessed. Secondly, information regarding anthropometric characteristics (e.g., BMI) and participants' health and dietary status, lifestyle habits like smoking and alcohol consumption, were not collected. Additionally, the survey did not include questions about the number of food supplements consumed, their doses and duration of use.

Conclusion

With the increasing rates of obesity and overweight, food supplements are becoming a popular weight-loss approach, which is confirmed by our findings. Successful weight management requires long-term lifestyle changes such as reducing calorie consumption and increasing physical activity under the supervision of a healthcare provider. However, because many people find lifestyle changes difficult, easily obtained food supplements are an appealing alternative to the increasingly overweight population. Since the Internet has become one of the primary and easily accessible sources of weight loss information, it often provides a "solution" for many overweight and obese people. However, in some cases, the quality of online information may be questionable, unreliable, and inaccurate. More attention and awareness from consumers and healthcare providers are needed regarding the potential risks related to the inappropriate use of food supplements as aids in reducing body weight.

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Supplementary material 1

Questionnaire

Authors: Radiana Staynova, Vesselina Yanachkova

Data type: docx

Explanation note: Self-administered questionnaire that was distributed among Bulgarian adults via social media (e.g., Facebook, Twitter) and mobile applications (e.g., Viber, WhatsApp) using the snowball sampling method.

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