Health Policy OPEN 8 (2025) 100136

Contents lists available at ScienceDirect

Health Policy OPEN

journal homepage: www.elsevier.com/locate/hpopen

Review article

The regulation on the use of supplements for weight control: Case studies from Australia, the United States of America, and the United Kingdom

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ARTICLE INFO

Keywords:
Weight loss supplement regulation
Eating disorders
Unhealthy weight control behaviors
TGA Australia
U.S. FDA
UK MHRA

ABSTRACT

Background: Overweight and obesity have become more prevalent worldwide which has led to an increase in the demand for non-prescribed weight loss supplements. Given that these products are loosely regulated, they are often misused by adolescents and young adults.
Objective: This study aims to review regulatory policies for weight loss supplements in Australia, the United States, and the United Kingdom to identify areas for improvement.
Method: Peer-reviewed literature was retrieved from EMBASE, OVID, and EBSCOhost databases. Grey literature was identified using Google Advanced Search with 32 targeted keywords and region-specific government domains (.gov.au, .gov, .gov.uk). A narrative synthesis was employed to analyze and compare regulatory policies.
Results: A total of 34 articles (7 peer-reviewed and 27 grey literature documents) were included. In Australia, weight loss supplements are classified as low-risk medicines and are not subject to pre-market regulation. In the United States, the Food and Drug Administration primarily enforces regulations post-market. In contrast, the United Kingdom has implemented proactive measures through collaborations between government organizations. These include restrictions on the sale and packaging of over-the-counter laxatives and mandatory pharmacist consultations to assess patient needs.
Conclusions: The findings highlight significant regulatory gaps in Australia and the US compared to the UK. Adopting similar policies to those implemented in the UK could help reduce the accessibility of weight loss supplements among at-risk populations like adolescents and young adults. This study also discusses the implications of these findings for developing effective policies and regulations for non-prescribed weight loss supplements.

1. Introduction

Overweight and obesity have long been recognized as significant global public health challenges. In 2022, around 2.5 billion adults (43 %) and 390 million children and adolescents aged 5–19 years (20 %) worldwide were considered overweight, reflecting a sharp increase since 1990 when only 25 % of adults and 2 % of children and adolescents were overweight [1]. The prevalence of overweight varied across regions but remained particularly high among high-income countries (HICs) such as the United States of America (US) (adults: 72 %; children and adolescents: 43 %), the United Kingdom (UK) (adults: 61 %; children and adolescents: 30 %), and Australia (adults: 64 %; children and adolescents: 36 %) [2–3]. Overweight and obesity were consistently associated with a wide range of health problems like cancers, cardiovascular diseases, diabetes, neurological disorders, respiratory diseases, and digestive disorders [4,5,6,7]. In 2019, such health conditions contributed to an estimated five million premature deaths [5] and imposed a staggering economic burden of US$2.5 trillion to the global economy, including approximately US$750 billion from the US, US$57 billion from the UK, and US$28 billion from Australia [8].

Several strategies have been developed to manage excess weight, including behavioral interventions, nutrition, physical activity, pharmacotherapy, and metabolic procedures [9]. Although physical activity and nutrition are relatively simple and effective strategies [10,11], their success depends heavily on patient compliance and persistence [12]. Over time, poor adherence often diminishes the long-term effectiveness of physical activity and nutrition strategies [10,13,14,15]. On the other hand, pharmacotherapy, using prescription medications such as

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https://doi.org/10.1016/j.hpopen.2025.100136
Received 12 May 2024; Received in revised form 2 February 2025; Accepted 6 February 2025
Available online 16 February 2025

Tirzepatide, Semaglutide, and Phentermine or Topiramate, offers greater and more rapid weight loss compared to physical activity and nutrition [16,9]. However, the use of pharmacotherapy is costly, less accessible, and often carries potential safety risks, including side effects like nausea, diarrhea, constipation, vomiting, and, in some cases, cancer [16,17,9,18]. Concerns over such risks have led to the withdrawal of several medications for obesity, including sibutramine and fenfluramine or phentermine, from the US market [19,20]. As a result, many patients seek alternative solutions, such as non-prescribed weight loss supplements (NWLS) [21,22].

In 2023, the global retail value of NWLS surpassed US$5 billion, with considerable contributions of US$ 1.1 billion from the US, US$ 0.7 billion from Australia, and US$ 0.2 billion from the UK [23]. The demand for NWLS is expected to grow as overweight and obesity become more prevalent, and consumers often perceive NWLS as a more affordable, lower-risk, and accessible option for achieving weight loss [24,25,22,26]. Despite inconclusive evidence of their effectiveness on actual weight loss [21], NWLS was used by approximately 2.0 % of adolescents globally in the past week, 4.4 % in the past month, 6.2 % in the past year, and 8.9 % in their lifetime, with the usage rates in the US and Australia remained mostly above the global average [24].

However, the use of NWLS for weight management among adolescents is not medically recommended due to significant health risks. These include an increased likelihood of mental health disorders (e.g. depression, eating disorders, etc.) [27,28,29], poor nutritional intake [30], and adverse health outcomes such as hepatotoxicity, gastrointestinal adverse events, heart palpitations, hypernatremia, and even death [31,32,33,34]. Furthermore, NWLS is frequently adulterated with unauthorized substances or medications, including anorectics, stimulants, antidepressants, diuretics, and laxatives, to promote rapid effects and increase sales [35,36,37,38]. These substances are challenging to detect [37] and can cause severe complications, especially when co-administrated with prescribed medications, including hepatotoxicity, cardiovascular issues, serotonin syndrome, reproductive health impairments, addiction, and life-threatening conditions such as cardiac arrhythmias and cancer [39,34].

Despite the above adverse health effects, NWLS products are often loosely regulated and easily accessible through e-commerce platforms, bypassing safety testing requirements, prescriptions, and physician oversight [12,37,40,34]. This lack of regulation underscores the urgent need for stricter controls, particularly for children and adolescents [24,35,34]. Thus, the present review aims to identify and synthesize grey and peer-reviewed literature on NWLS regulations to highlight regulatory gaps in the US, UK, and Australia. By comparing policies in these countries, the review seeks to identify similarities and differences in addressing the risks associated with NWLS misuse among adolescents and young adults under 25.

2. Methods

This review adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines[41]. The protocol was registered on PROSPERO (registration number CRD42021279273).

2.1. Search strategy and selection of studies

Relevant peer-reviewed literature on NWLS policies and regulations, published up to 17 October 2021, was identified through a systematic search on several academic research platforms such as Embase, Ovid, and EBSCO host. Search terms were developed based on the population, interventions, comparators, and outcome (PICO) framework for the research question, encompassing four main concepts: (i) Population (adolescents and young adults); (ii) Intervention (weight loss supplements); (iii) Comparator (prescribed medication); (iv) Outcome (policies and regulations). Detailed search strategies are provided in Appendix A.

Additionally, the grey literature search was conducted through Google Advanced Search with Boolean operators and a 32-word limit per concept. To optimize the search efficiency, only search terms related to ‘weight loss supplement’ and ‘policy’ were included (details in Appendix B). The search strategy also targeted the official government domains for each country by narrowing the results to government websites or databases (.gov.au,.gov, and.gov.uk). For each country, 30 references were identified and further analyzed for relevant cross-references.

All citations retrieved from the systematic search were imported into Endnote® (version 20) for duplicate removal. Subsequently, Covidence, a web-based screening tool, was used to facilitate a blinded screening process. Two independent reviewers screened the titles and abstracts of each record and conducted full-text reviews to determine eligibility based on pre-defined inclusion and exclusion criteria. Any conflicts between the reviewers were resolved through arbitration by a third reviewer.

2.2. Inclusion and exclusion criteria

This review focused on the policies and regulations surrounding NWLS usage among adolescents and young adults under 25 in the US, the UK, and Australia. Inclusion and exclusion criteria were developed based on the previously specified PICO framework and aligned with Cochrane Training’s [42] guidelines. Studies were included if they targeted individuals aged 25 years or younger residing in the US, the UK, or Australia, were peer-reviewed or policy-related, written in English, and published within the last 20 years. Exclusion criteria encompassed studies focusing on populations older than 25 or those outside the target countries, clinical trials, conference proceedings, treatment guidelines, publications older than 20 years, and articles in languages other than English.

2.3. Data extraction and synthesis

Key information from the included studies was systematically extracted and summarized in tabular format to facilitate the synthesis and comparison of NWLS policies and regulations in the US, UK, and Australia. The extracted data included details of regulatory agencies, associated agencies, applied legislation and regulation policies, supplementary regulations, pre-market and post-market evaluation practices, professional conduct guidelines, and public health surveillance strategies. Additionally, information on future planning initiatives, such as age restrictions and packaging reforms, as well as other relevant details regarding professional acknowledgment, recommendations, and exemptions were also extracted and presented in a table format. For each of the three target countries, NWLS policies and regulations were synthesized and described based on these key aspects. The discussion section then analyzed the similarities and differences in how NWLS products were regulated across the three countries.

3. Results

The systematic search identified 2,145 peer-reviewed articles. After removing 176 duplicates, 1,945 articles were excluded based on their title and abstract, and 12 were excluded following a full-text review. This process left seven peer-reviewed articles for data extraction, all of which focused on policies and regulations in the US. Additionally, the grey literature search identified another 106 studies and reports across the three target countries, of which 27 met the eligibility criteria for data extraction. In total, 34 articles and reports were included in the review (Fig 1). Key information was extracted, summarized, and presented in Table 1.

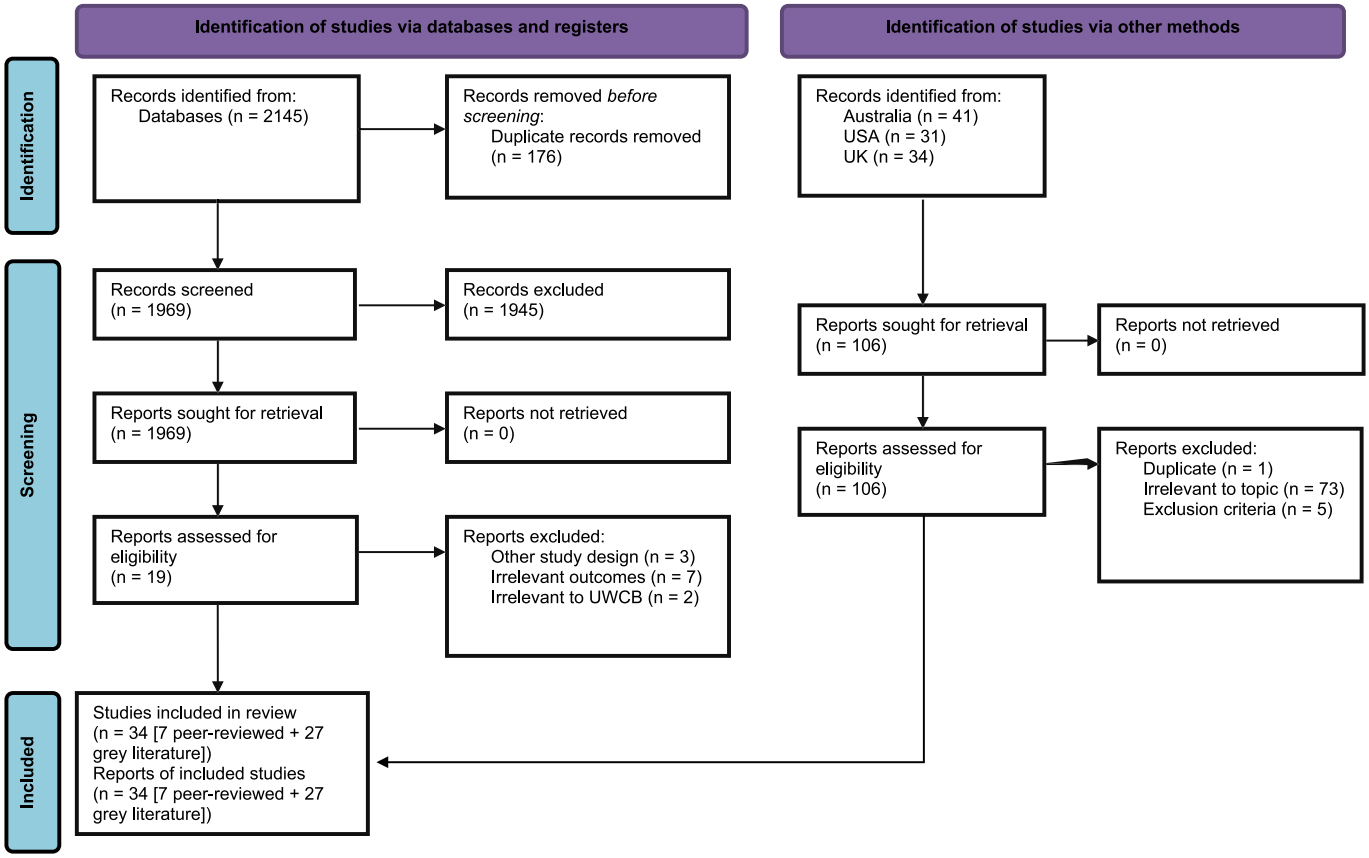

Fig. 1. Preferred Reporting Items for Systematic Reviews and Meta-Aalyses flow diagram of study selection, inclusion and exclusion of studies[41]. USA, United States of America. UK, United Kingdom. UWCB, Unhealthy Weight Control Behaviours.

3.1. *Summary of findings*

Australian Policies: The limited available literature indicates that the Therapeutic Goods Administration (TGA) employs a risk-based regulatory framework for therapeutic goods, governed by the Therapeutic Goods Act 1989 and the Therapeutic Goods Regulation 1990 Administration [43], Therapeutic Goods Administration [44,45], 2021. This framework uses a two-tiered system to classify products as low-risk or high-risk medicines. NWLS products are categorized as low-risk medicines under the Australian Register of Therapeutic Goods (ARTG), meaning they are not subject to laboratory assessment prior to market distribution Administration [43], Therapeutic Goods Administration [46], Therapeutic Goods Administration [44,45,47]. Notably, the TGA does not regulate products manufactured overseas and imported to Australia via e-commercial platforms but advises consumers against purchasing such products online [47].

The TGA's risk-based approach, outlined in Section 29A of the Act, places the responsibility for reporting adverse events on consumers, product sponsors, and health professionals Therapeutic Goods Administration [48], Therapeutic Goods Administration [44]. This system reduces the costs associated with pre-market product evaluations while focusing on post-market monitoring Therapeutic Goods Administration [44], Therapeutic Goods Administration [45]. To ensure transparency and prevent misleading claims, the Therapeutic Goods Labelling Order and Therapeutic Goods Advertising Code mandate clear and accurate labeling. For example, NWLS cannot include guarantees of specific outcomes such as accelerated weight loss, increased metabolism, or appetite suppression within defined timeframes Therapeutic Goods Administration [49], Therapeutic Goods Administration [50], 2021.

For post-market evaluation, the ARTG implements a pharmacovigilance program that conducts compliance reviews through randomly selected or targeted product testing. Findings from these reviews are made publicly available in the TGA Annual Performance Statistics Report, enabling consumers to identify withdrawn or non-compliant products Therapeutic Goods Administration [44], Therapeutic Goods Administration [51,47].

To strengthen the existing regulatory framework, the TGA has initiated reforms aimed at enhancing self-regulation, advancing technology to enable more adverse event reporting, improving the pharmacovigilance program, and regularly benchmarking practices against international regulatory standards Therapeutic Goods Administration [52]. Additionally, the Australian government has begun implementing the National Code of Conduct for Health Care Workers to ensure healthcare professionals provide services safely and ethically, take appropriate actions in response to adverse events, refrain from making inappropriate claims about curing serious illnesses, and fully inform their clients about the products and services they provide Therapeutic Goods Administration [49].

The US's Policies: In the United States, the regulation of NWLS is primarily governed at the federal level by the Dietary Supplement Health and Education Act (DSHEA) 1994, which classifies NWLS as dietary supplements rather than medications. This classification limits the regulatory authority of the Food and Drug Administration (FDA), exempting NWLS from pre-market safety and efficacy testing [53,54]. Instead, manufacturers are responsible for ensuring product safety, quality, and accurate labeling prior to market distribution [54]. However, studies indicate significant gaps in compliance, with numerous NWLS products being sold despite containing unapproved or harmful substances, mislabeling of ingredients, and unsubstantiated health claims [55],Food and Drug Administration [56], Food and Drug Administration [57,58–59,60,61].

The FDA's role is restricted to post-market surveillance. Under the

Table 1
Summary of Government regulatory agencies, policies, acts and plans for the regulation of non-prescribed weight-loss supplements in Australia, the United States of America, and the United Kingdom.

Australia	United States of America	United Kingdom	Source(s)
Regulatory Agencies			
TGA	FDA	MHRA	(FDA, 2019; Government of the United Kingdom, 2021b; TGA, 2019d)
Associated Agencies			
ARTG	FTC	FSA, CHM, RPS, European Union, Emerging Risks Network	[81]; MHRA, 2020a, 2020c; [59]; TGA, 2017c; [75]
Applied Legislation and Regulation Policies			
Therapeutic Goods Act 1989, Therapeutic Goods Regulation 1990	Dietary Supplement Health and Education Act 1994	UK food and feed legislation, Food Safety Act 1990, and the Food Standards Act 1999	(FDA, 2019; TGA, 2021; [75]
Supplementary Legislation and Regulation Policies			
Therapeutic Goods Labelling Order, Therapeutic Goods Advertising Code	Federal Trades Commission Act	EU regulation 1169/2011 for total diet replacement for weight control products, The Foods Intended for Use in Energy Restricted Diets for Weight Reduction Regulations 1997	Federal Trade Commission [63,81], Therapeutic Goods Administration [49]
Category (High/Low-Risk/Other)			
Low-risk (Medicines)	Other: Foods	Other: Foods	(FDA, 2019; Agency [73]; TGA, 2019d)
Pre-market Evaluation			
No. Pre-market evaluation for high-risk medicines only.	No. Pre-market evaluation for medication with intended therapeutic use only.	No.	(FDA, 2019; Agency [73]; TGA, 2019d)
Post-market Evaluation			
Yes. Post-market monitoring of products via random product review or consumer report targeted product review.	Yes. Post-market investigation for consumer report targeted products to assess safety and efficacy.	Yes. Post-market surveillance and evaluation performed by the FSA to implement the UK food and feed legislation, Food Safety Act 1990, and the Food Standards Act 1999.	(FDA, 2019; TGA, 2017c; [75]
Public Health Surveillance Planning and Actioning			
– Honour system where consumers/ product sponsors/ health professionals are responsible for reporting associated adverse events to TGA. – A pharmacovigilance program involves laboratory testing of products selected for compliance review to ensure safety and adherence to regulations. – Publication of TGA Annual Performance Statistics Report to inform consumers of canceled or non-compliant products.	– Honour system where manufacturers and sponsors are responsible for conducting safety and efficacy tests of their products before market distribution. – The FDA investigates the safety and efficacy of supplements reported to cause adverse events. – The FTC oversees the advertising and marketing of weight-loss supplements across media outlets, online platforms, and print materials, enforcing compliance with the FTC Act.	– The MHRA publishes a monthly report, the MHRA Drug Safety Update, which provides the latest information and guidance on the safety and efficacy of drugs and medicines. – Based on these findings, the MHRA, CHM, and the UK Government may introduce new regulations to enhance drug and medicine safety.	(FTC, 2011; Food and Drug Administration [56]; MMedicines and Healthcare products Regulatory Agency [72], Medicines and Healthcare products Regulatory Agency [79,59]; TGA, 2017c, 2023)

ARTG – Australian Register of Therapeutic Goods; CHM – Committee of Human Medicines; DSLD – Dietary Supplement Label Database; FDA – Food and Drug Administration; FSA – Food Standards Agency; FTC – Federal Trades Commission; MHRA – Medicines and Healthcare products Regulatory Agency; OTC – Over-The-Counter; UK – United Kingdom; RPS – Royal Pharmaceutical Society; TGA – Therapeutics Goods Administration.

Dietary Supplement and Non-prescription Drug Consumer Protection Act, the FDA relies on reports of adverse events from consumers, healthcare providers, and manufacturers to identify unsafe products. When necessary, the Center for Food Safety and Applied Nutrition (CFSAN) investigates products and removes non-compliant items from the market [60]. However, the FDA's enforcement capacity remains limited, as NWLS products can legally be sold without rigorous pre-market evaluation Food and Drug Administration [56], Food and Drug Administration [57],Federal Trade Commission [62].

The Federal Trade Commission (FTC) complements FDA oversight by regulating the marketing and advertising of NWLS products under the FTC Act. The FTC actively monitors media channels for false or misleading advertising claims, such as guarantees of rapid weight loss or appetite suppression, and pursues legal action against companies that violate these standards Federal Trade Commission [63,64,59].

Some state governments have sought to address the federal regulatory gaps through several proposed legislation. For instance, both Massachusetts House Bill 3471 in 2015 and New York Senate Bill S8089 in 2019 (which was passed into law in early 2024) sought to impose age restrictions (minimum age of 18) for purchasing NWLS products and require warning labels detailing potential health risks [65,66,67,68]. These state laws and proposed legislation were driven by concerns over the lack of pre-market safety testing, the adulteration of unregulated ingredients, and the accessibility of potentially unsafe NWLS products [69,68]. Despite these efforts, many state governments still face significant challenges in enacting such regulations, largely due to a lack of high-quality data and supporting evidence to sufficiently inform policy decisions [65,70,68,61].

As a result, health professionals often encourage consumers to use the Dietary Supplement Label Database (DSLD) as a resource for researching the safety and composition of NWLS products [55]. Additionally, the FDA's website provides updates on safety alerts and product recalls, placing responsibility on consumers to stay informed about

potential risks Food and Drug Administration [57].

The UK's Policies: In the UK, therapeutic goods are regulated by the Medicines and Healthcare Products Regulatory Agency (MHRA), which collaborates with various organizations to adapt policies in response to current and emerging health concerns Government of the United Kingdom [71],Medicines and Healthcare products Regulatory Agency [72]. NWLS, however, are classified as foods and regulated by the Food Standards Agency (FSA). The FSA oversees post-market surveillance of NWLS under the UK food and feed legislation, the Food Safety Act 1990, and the Food Standards Act 1999 Agency [73,74,75].

The regulation of NWLS has been strengthened in response to evidence of non-compliance and risks associated with certain products. Investigations by the MHRA uncovered that some diet pills contained 2,4-Dinitrophenol (DNP), a poisonous substance known for its severe health risks (e.g. cardiovascular issues, headaches, vomiting, and even death) Government of the United Kingdom [76]. These findings led to the prohibition of DNP-containing products in the UK, alongside stricter enforcement against misleading marketing practices for NWLS products, particularly on social media platforms and retail outlets Government of the United Kingdom [76].

The MHRA has also implemented significant regulatory changes for over-the-counter laxatives, often used as WLS products, due to concerns about their inappropriate use. As outlined in the Medicines and Healthcare products Regulatory Agency [72], these changes include three key points. Firstly, OTC laxatives are now restricted to individuals aged 18 and above. Consumers under 18 may only purchase laxatives following a mandatory consultation with a pharmacist [77],Medicines and Healthcare products Regulatory Agency [72], Medicines and Healthcare products Regulatory Agency [78]. Secondly, package sizes for laxatives have been revised and reduced to limit general sale products to amounts suitable for only two short treatment courses for constipation. These restrictions include a maximum of 20 standard-strength tablets, 10 maximum-strength tablets, or 100 ml of solution/syrup [77], Medicines and Healthcare products Regulatory Agency [72], Medicines and Healthcare products Regulatory Agency [79]. Lastly, new labeling requirements mandate that stimulant laxatives explicitly state they are not effective for weight loss. Packaging must also include educational leaflets warning about the health risks of overuse [77],Medicines and Healthcare products Regulatory Agency [78].

To ensure effective implementation, the MHRA and the Royal Pharmaceutical Society (RPS) developed the Pharmacy Guide, a national framework providing guidance to pharmacists on adhering to the revised regulations. This guide emphasizes standard practices for pharmacist consultations and safe dispensing of laxatives Medicines and Healthcare products Regulatory Agency [72], Medicines and Healthcare products Regulatory Agency [79].

4. Discussion

Our study found that Australia, the US, and the UK generally follow similar approaches to regulate NWLS, primarily relying on post-market surveillance instead of pre-market evaluations. In Australia, NWLS are classified as low-risk medicines by the TGA, which exempts these products from pre-market assessments Administration [43], Therapeutic Goods Administration [46], Therapeutic Goods Administration [44,45,47]. Similarly, the US regulates NWLS as dietary supplements under the Dietary Supplement Health and Education Act (DSHEA) of 1994, also exempting them from pre-market safety and efficacy testing Food and Drug Administration [56], Food and Drug Administration [57]. In the UK, NWLS are categorized as foods and are overseen by the FSA, where pre-market evaluations are not required. Across all three countries, pre-market regulation is limited and ineffective [54], resulting in safety assessments being largely dependent on post-market mechanisms Agency [73].

Post-market surveillance frameworks, however, reveal some distinctions. The UK has implemented more proactive measures, such as mandatory pharmacist consultations and reduced packaging sizes for over-the-counter laxatives to address misuse concerns. Australia's pharmacovigilance program emphasizes targeted compliance reviews and transparency through public reporting of adverse events. In contrast, the US relies heavily on manufacturers to ensure product safety before distribution, with the FDA intervening only after adverse event reports. While all three countries share a reliance on post-market oversight, the UK's reforms demonstrate a more rigorous and preventative approach compared to the relatively reactive systems in Australia and the US.

All three countries have strict labeling and advertising requirements, though enforcement varies. In Australia, the Therapeutic Goods Advertising Code prohibits guarantees of specific outcomes, such as accelerated weight loss, on weight loss supplement labels. The US relies on the FTC to oversee advertising practices. However, enforcement can be challenging due to the absence of pre-market evaluations, which allows non-compliant products to enter the market. In the UK, detailed labeling regulations are enforced, particularly for over-the-counter laxatives. Packaging must clearly indicate that stimulant laxatives are not effective for weight loss and must include warnings about the health risks associated with overuse [77],Medicines and Healthcare products Regulatory Agency [78].

The systems for public health surveillance and consumer protection also highlight key differences. Australia relies on a self-regulatory system where consumers, sponsors, and health professionals report adverse events Therapeutic Goods Administration [48], Therapeutic Goods Administration [44]. The TGA publishes the Annual Performance Statistics Report to enhance transparency Therapeutic Goods Administration [44], Therapeutic Goods Administration [51,47]. In the US, the regulations place responsibility on manufacturers to ensure product safety before distribution. The FDA's post-market surveillance depends on consumer and healthcare provider reports, limiting its proactive enforcement capacity Food and Drug Administration [56], Food and Drug Administration [57]. The UK implements proactive measures, including the MHRA's Drug Safety Updates, which address emerging health concerns and guide pharmacists in implementing regulatory changes (MHRA, 2020a, Medicines and Healthcare products Regulatory Agency [78].

Future policy planning in all three countries reflects efforts to close these regulatory gaps. Australia aims to enhance its self-regulation framework, improve adverse event reporting through advanced technology, and align its pharmacovigilance practices with international standards. In the US, state-level progress on NWLS regulation (e.g. Massachusetts House Bill 3471) continues to gain momentum, with initiatives emphasizing consumer safety and accountability. Notably, the New York State enacted Senate Bill S8089 in early 2024, which prohibits the online and in-person sales of NWLS to individuals below 18 years old throughout the state. The UK, which has already implemented significant reforms targeting over-the-counter laxatives, remains committed to further refining its regulatory framework based on emerging public health surveillance data.

The UK's regulatory framework for NWLS demonstrates the effectiveness of a coordinated, evidence-informed approach to public health policy. Key success factors include inter-agency collaboration and active stakeholder engagement, which have enabled proactive reforms to mitigate health risks. For instance, amendments to the Food Safety Act 1990 introduced stringent restrictions on laxatives, highlighting how leveraging existing legislative frameworks can address emerging public health challenges. This integrated and preventative strategy contrasts sharply with the regulatory gaps seen in Australia and the US, where enforcement is fragmented and resource limitations impede thorough oversight.

Specifically, in the US, localized initiatives like the New York Senate Bill S8089, which became a state law in early 2024, offer promising examples of state-level action to counter federal regulatory shortcomings. These measures, including age restrictions and mandatory warning

labels, underscore growing concerns about adolescent health risks. However, systemic reform is hampered by industry resistance and legal challenges, leaving significant gaps in national oversight. Similarly, Australia's reliance on post-market surveillance and the lack of pre-market evaluation expose consumers to risks, especially as unregulated NWLS products become increasingly accessible through online retailers.

4.1. Policy implications and recommendations

Policymakers may consider the following recommendations to address regulatory gaps and mitigate the public health risks associated with NWLS. First, the three countries included in this review should explore the process of pre-market evaluation requirements to ensure that NWLS meets safety and efficacy standards prior to market distribution. This shift would align these nations with the best practices and help to prevent harmful or ineffective products from reaching consumers. Lessons from these countries could be applied to other countries where NWLS have not been regulated as pre-market evaluation.

Second, enhancing inter-agency collaboration is critical for effective regulation. Regulatory agencies should strengthen partnerships with healthcare professionals, academic researchers, and advocacy organizations. Such collaboration would facilitate the identification of gaps in NWLS regulation, improve compliance monitoring, and ensure that policies reflect the latest evidence on public health risks. For example, a simulation by Austin et al. [70] indicated that implementing a 20 % added tax could reduce adolescent purchases of NWLS products in the US by 17.5 %. Furthermore, in countries with fragmented regulatory systems like the US, implementing uniform national standards should be a priority. Establishing comprehensive guidelines, similar to the UK's Pharmacy Guide, would help standardize enforcement across jurisdictions, reducing inconsistencies and enhancing consumer protection.

Online sales and marketing also pose significant challenges in regulating NWLS. There is substantial evidence demonstrating that online marketing and sales not only influence what is consumed and by whom, but also shape social norms and expectations around weight stigma. Traditionally, online marketing and sales have been considered distinct activities. However, there is increasing the use of online advertising as a storefront, with ads directly linking to online retail sites and apps where harmful products (e.g. alcohol) can be purchased and quickly delivered to people's homes [80]. Stricter oversight of digital platforms is necessary to address the increase of unregulated products and the prevalence of misleading advertising. Governments should enforce stricter controls on social media and e-commerce platforms, focusing on deceptive claims and the accessibility of potentially harmful NWLS.

Finally, public awareness campaigns are essential to reduce the misuse of NWLS. Educational initiatives should target consumers, particularly adolescents, to raise awareness about the health risks associated with NWLS misuse and to promote evidence-based approaches to weight management. These campaigns should incorporate clear, engaging content on body image, nutrition, and the dangers of unsupervised supplement use to encourage healthier behaviors.

Collectively, these measures highlight the need for a comprehensive, multi-level approach to NWLS regulation. By addressing pre-market evaluation, regulatory collaboration, enforcement consistency, online sales, and public education, policymakers can better safeguard public health and reduce the burden of NWLS misuse, particularly among vulnerable populations like adolescents and young adults.

4.2. Limitations

The main limitation of the present study came from the relatively low number of studies available for policy review. For instance, only seven peer-reviewed studies were included, highlighting the scarcity of research on this topic. Although the grey literature search using Google Advanced Search increased the number of included studies, the results were restricted to government domains to ensure accuracy and credibility. In addition, the grey literature search may be difficult to replicate due to variations in search algorithms, geographic location, language, and the continuous addition of new source material online. Lastly, since this review only focused on policies and regulations in HICs with similar socioeconomic status, the findings may not be representative. To strengthen future research, a broader global search effort is needed to capture a more comprehensive and diverse range of case studies and policy data.

5. Conclusion

While some progress has been made, significant gaps remain in the regulation of NWLS in Australia, the US, and the UK. Reliance on post-market surveillance, rather than pre-market evaluation, leaves consumers at risk of harmful or untested products. The UK's proactive reforms, including stricter oversight and collaboration with stakeholders, provide a strong model for addressing these challenges. In comparison, Australia's self-regulatory framework and the US's fragmented enforcement systems demonstrate significant weaknesses. Thus, both countries would benefit from adopting pre-market evaluation requirements, streamlining enforcement, and improving consumer protections, particularly against unregulated online sales.

Ethics approval and consent to participate

Ethical approval for the study was sought from the Deakin University Human Research Ethics Committee (Project ID: 2021–116).

Funding

There is no funding associated with the work featured in this article. Long Le is funded by the Alfred Deakin Postdoctoral Fellowship during this project.

Authors' contributions

LKDL and EJT conceptualized and designed the study. SD carried out the acquisition. SD and DQL conducted analysis and interpretation of data, drafted the initial manuscript, and reviewed and revised the manuscript. LKDL and EJT contributed to the data analysis and interpretation and provided critical revisions to the manuscript. All authors approved the final version of the manuscript and accepted accountability for all aspects of the work. The corresponding author had full access to all study data and held final responsibility for the decision to submit the manuscript for publication.

CRediT authorship contribution statement

Saiya Whitney Dawson: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation. **Dai Quy Le:** Writing – review & editing, Validation, Data curation. **Eng Joo Tan:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Investigation, Conceptualization. **Long Khanh-Dao Le:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A

Peer Reviewed Literature Keywords

Table A1
Database Search Strategy Concept

Concept	Keywords
Concept 1	'Adolescent*' OR 'Young adult*' OR 'Teen*' OR 'Youth*' OR 'Child*' OR 'Pediatric*' OR 'Paediatric*'
Concept 2	'Duromine' OR 'laxative*' OR 'diet pill*' OR 'appetite suppress*' OR 'weight loss pill*' OR 'complement* medic*' OR 'Orlistat' OR 'Xenical' OR 'Alli' OR 'weight loss drug*' OR 'weight loss medic*' OR 'body weight loss' *Refer to Additional Keywords below*
Concept 3	'Prescri*' OR 'Over the counter' OR 'Behind the counter' OR 'Pharmac*'
Concept 4	'Regulat*' OR 'Policy' OR 'Policies' OR 'Guideline*' OR 'Law*' OR 'Drug control*'

Additional key words (ingredients in weight loss supplements): 'Beta-glucans' OR 'Synephrine' OR 'Caffeine' OR 'Capsaicin' OR 'Carnitine' OR 'Chitosan' OR 'Chromium' OR 'Forskolin' OR 'Conjugated linoleic acid' OR 'Fucoxanthin' OR 'Hydroxycitric acid' OR 'Glucomannan' OR 'Guar gum' OR 'Hoodia' OR 'Pyruvate' OR 'Raspberry ketone' OR 'White kidney bean' OR 'Yohimbe'

Appendix B. Grey Literature Keywords

.

Table B1
Google Search Strategy Concept

Concept	Keywords
Concept 1	"Weight loss supplement" OR laxative OR "diet pill" OR "appetite suppress" OR "weight loss pill" OR "complementary medicine" OR "weight loss drug" OR "weight loss medication"
Concept 2	Policy OR "Over the counter" OR "Behind the counter" OR Pharmacy OR Regulate OR Policies OR Guideline OR Law

Data availability

The data that support the findings of this study are openly available in FigShare at https://doi.org/10.6084/m9.figshare.22346302, reference number https://doi.org/10.6084/m9.figshare.22346302.

References

References marked with an asterisk indicate studies that were also included in the narrative synthesis.

[1] WHO. (2024a). Obesity and overweight. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight.

[2] WHO. (2024b). Prevalence of overweight among adults, BMI >= 25 (age-standardized estimate) (%). https://www.who.int/data/gho/data/indicators/indicator-details/GHO/prevalence-of-overweight-among-adults-bmi–25-(age-standardized-estimate)-(-).

[3] WHO. (2024c). Prevalence of overweight among children and adolescents, BMI > +1 standard deviations above the median (crude estimate) (%). https://www.who.int/data/gho/data/indicators/indicator-details/GHO/prevalence-of-overweight-among-children-and-adolescents-bmi-1-standard-deviations-above-the-median-(crude-estimate)-(-).

[4] Dwivedi AK, Dubey P, Cistola DP, Reddy SY. Association Between Obesity and Cardiovascular Outcomes: Updated Evidence from Meta-analysis Studies. Curr Cardiol Rep 2020;22(4):25. https://doi.org/10.1007/s11886-020-1273-y.

[5] Global Burden of Disease 2019 Risk Factor Collaborators. (2020). Global burden of 87 risk factors in 204 countries and territories, 1990–2019: A systematic analysis for the Global Burden of Disease Study 2019—The Lancet. https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30752-2/fulltext.

[6] Lonardo A, Mantovani A, Lugari S, Targher G. Epidemiology and pathophysiology of the association between NAFLD and metabolically healthy or metabolically unhealthy obesity. Ann Hepatol 2020;19(4):359–66. https://doi.org/10.1016/j.aohep.2020.03.001.

[7] Musiager AO, Al-Hazzaa HM. Prevalence and risk factors associated with nutrition-related noncommunicable diseases in the Eastern Mediterranean region. Int J General Med 2012;5:199–217. https://doi.org/10.2147/IJGM.S29663.

[8] Okunogbe A, Nugent R, Spencer G, Powis J, Ralston J, Wilding J. Economic impacts of overweight and obesity: Current and future estimates for 161 countries. BMJ Glob Health 2022;7(9):e009773. https://doi.org/10.1136/bmjgh-2022-009773.

[9] Elmaleh-Sachs A, Schwartz JL, Bramante CT, Nicklas JM, Gudzune KA, Jay M. Obesity Management in Adults: A Review. JAMA 2023;330(20):2000–15. https://doi.org/10.1001/jama.2023.19897.

[10] Canuto R, Garcez A, de Souza RV, Kac G, Olinto MTA. Nutritional intervention strategies for the management of overweight and obesity in primary health care: A systematic review with meta-analysis. Obes Rev 2021;22(3):e13143. https://doi.org/10.1111/obr.13143.

[11] Ghoreishy SM, Noormohammadi M, Zeraattalab-Motlagh S, Shoaibinobarian N, Hasan Rashedi M, Movahed S, et al. The Effectiveness of Nonsurgical Interventions for Weight Loss Maintenance in Adults: An Updated, GRADE-Assessed Systematic Review and Meta-Analysis of Randomized Clinical Trials. Nutr Rev 2024;nuae128. https://doi.org/10.1093/nutrit/nuae128.

[12] Dini I, Mancusi A. Weight Loss Supplements. Article 14 Molecules 2023;28(14). https://doi.org/10.3390/molecules28145357.

[13] Curioni CC, Lourenço PM. Long-term weight loss after diet and exercise: A systematic review. Int J Obes (Lond) 2005;29(10):1168–74. https://doi.org/10.1038/sj.ijo.0803015.

[14] Machado AM, Guimarães NS, Bocardi VB, da Silva TPR, Carmo AS do, Menezes MC de, Duarte CK. Understanding weight regain after a nutritional weight loss intervention: Systematic review and meta-analysis. Clinical Nutrition ESPEN 2022;49:138–53. https://doi.org/10.1016/j.clnesp.2022.03.020.

[15] Wadden TA, Butryn ML, Hong PS, Tsai AG. Behavioral treatment of obesity in patients encountered in primary care settings: A systematic review. JAMA 2014;312(17):1779–91. https://doi.org/10.1001/jama.2014.14173.

[16] Bessesen DH, Gaal LFV. Progress and challenges in anti-obesity pharmacotherapy. Lancet Diabetes Endocrinol 2018;6(3):237–48. https://doi.org/10.1016/S2213-8587(17)30236-X.

[17] Bray GA. Medical treatment of obesity: The past, the present and the future. Best Pract Res Clin Gastroenterol 2014;28(4):665–84. https://doi.org/10.1016/j.bpg.2014.07.015.

[18] Hong J-L, Meier CR, Sandler RS, Jick SS, Stürmer T. Risk of colorectal cancer after initiation of orlistat: Matched cohort study. BMJ (Clinical Research Ed) 2013;347:f5039. https://doi.org/10.1136/bmj.f5039.

[19] Daneschvar HL, Aronson MD, Smetana GW. FDA-Approved Anti-Obesity Drugs in the United States. Am J Med 2016;129(8):879.e1–6. https://doi.org/10.1016/j.amjmed.2016.02.009.

[20] Food and Drug Administration. (2020). FDA requests the withdrawal of the weight-loss drug Belviq, Belviq XR (lorcaserin) from the market. FDA. https://www.fda.gov/drugs/drug-safety-and-availability/fda-requests-withdrawal-weight-loss-drug-belviq-belviq-xr-lorcaserin-market.

[21] Batsis JA, Apolzan JW, Bagley PJ, Blunt HB, Divan V, Gill S, et al. A systematic review of dietary supplements and alternative therapies for weight loss. Obesity 2021;29(7):1102–13. https://doi.org/10.1002/oby.23110.

[22] Reid I. Natural Health Product Tracking Survey – 2010 Final Report. Health Canada 2011. https://epe.lac-bac.gc.ca/100/200/301/pwgsc-tpsgc/por-ef/health/2011/135-09/report.pdf.

[23] Euromonitor. (2024). Consumer Health: Euromonitor from trade sources/national statistics. https://www.portal.euromonitor.com/StatisticsEvolution/index.

[24] Hall NY, Hetti Pathirannahalage DM, Mihalopoulos C, Austin SB, Le L. Global Prevalence of Adolescent Use of Nonprescription Weight-Loss Products: A Systematic Review and Meta-Analysis. JAMA Netw Open 2024;7(1):e2350940. https://doi.org/10.1001/jamanetworkopen.2023.50940.

[25] Pillitteri JL, Shiffman S, Rohay JM, Harkins AM, Burton SL, Wadden TA. Use of dietary supplements for weight loss in the United States: Results of a national survey. Obesity (Silver Spring. Md) 2008;16(4):790–6. https://doi.org/10.1038/oby.2007.136.

[26] Zhivikj Z, Petreska Ivanovska T, Karapandjova M, Kulevanova S, Lonchar Velkova M, Petrushevska-Tozi L. Consumer perception of risk-benefit of weight loss supplements and building safety. Macedonian Pharm Bull 2020;66(03):45–6. https://doi.org/10.33320/maced.pharm.bull.2020.66.03.022.

[27] Hazzard VM, Simone M, Austin SB, Larson N, Neumark-Sztainer D. Diet pill and laxative use for weight control predicts first-time receipt of an eating disorder diagnosis within the next 5 years among female adolescents and young adults. Int J Eat Disord 2021;54(7):1289–94. https://doi.org/10.1002/eat.23531.

[28] Levinson JA, Sarda V, Sonneville K, Calzo JP, Ambwani S, Austin SB. Diet Pill and Laxative Use for Weight Control and Subsequent Incident Eating Disorder in US Young Women: 2001–2016. Am J Public Health 2020;110(1):109–11. https://doi.org/10.2105/AJPH.2019.305390.

[29] Stephen EM, Rose JS, Kenney L, Rosselli-Navarra F, Weissman RS. Prevalence and correlates of unhealthy weight control behaviors: Findings from the national longitudinal study of adolescent health. J Eat Disord 2014;2(1):16. https://doi.org/10.1186/2050-2974-2-16.

[30] Neumark-Sztainer D, Wall M, Guo J, Story M, Haines J, Eisenberg M. Obesity, Disordered Eating, and Eating Disorders in a Longitudinal Study of Adolescents: How Do Dieters Fare 5 Years Later? J Am Diet Assoc 2006;106(4):559–68. https://doi.org/10.1016/j.jada.2006.01.003.

[31] Pittler MH, Schmidt K, Ernst E. Adverse events of herbal food supplements for body weight reduction: Systematic review. Obes Rev 2005;6(2):93–111. https://doi.org/10.1111/j.1467-789X.2005.00169.x.

[32] Watanabe M, Risi R, Masi D, Caputi A, Balena A, Rossini G, et al. Current Evidence to Propose Different Food Supplements for Weight Loss. Article 9 Nutrients 2020;12(9). https://doi.org/10.3390/nu12092873.

[33] Wierzejska RE. Dietary Supplements—For Whom? The Current State of Knowledge about the Health Effects of Selected Supplement Use. Article 17 Int J Environ Res Public Health 2021;18(17). https://doi.org/10.3390/ijerph18178897.

[34] Zhivikj, Z., Ivanovska, T. P., Karapandzova, M., Kulevanova, S., Panovska, T. K., & Petrushevska-Tozi, L. Safety issues of herbal weight loss dietary supplements: Hepatotoxicity and adulteration. Arch Pharm, 74(Notebook 3), Article Notebook 3; 2024. Doi: 10.5937/arhfarm74-50463.

[35] Koncz D, Tóth B, Roza O, Csupor D. A Systematic Review of the European Rapid Alert System for Food and Feed: Tendencies in Illegal Food Supplements for Weight Loss. Front Pharmacol 2021;11. https://doi.org/10.3389/fphar.2020.611361.

[36] Muschietti L, Redko F, Ulloa J. Adulterants in selected dietary supplements and their detection methods. Drug Test Anal 2020;12(7):861–86. https://doi.org/10.1002/dta.2806.

[37] Rocha T, Amaral JS, Oliveira MBPP. Adulteration of Dietary Supplements by the Illegal Addition of Synthetic Drugs: A Review. Compr Rev Food Sci Food Saf 2016;15(1):43–62. https://doi.org/10.1111/1541-4337.12173.

[38] Velasquez K, Ivie A, Fegely SR, Raffoul A, Vitagliano JA, Roberto CA, et al. Dietary supplements for weight loss: legal basis for excise tax and other government action to protect consumers from a public health menace. Am J Law Med 2022;48(1):38–53. https://doi.org/10.1017/amj.2022.12.

[39] Jairoun AA, Al-Hemyari SS, Shahwan M, Zyoud SH. Adulteration of Weight Loss Supplements by the Illegal Addition of Synthetic Pharmaceuticals. Article 22 Molecules 2021;26(22). https://doi.org/10.3390/molecules26226903.

[40] Wróbel-Harmas M, Krysińska M, Postupolski J, Wysocki MJ. Food supplement-related risks in the light of internet and RASFF data. Przegl Epidemiol 2014;68(4):613–9.

[41] Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. BMJ 2021;372:n71. https://doi.org/10.1136/bmj.n71.

[42] Training C. Chapter 3: Defining the criteria for including studies and how they will be grouped for the synthesis. In Cochrane Handbook for Systematic Reviews of Interventions. 2024.

[43] *Therapeutic Goods Administration. (2014). A summary of supplying therapeutic goods in Australia [Text]. Therapeutic Goods Administration (TGA). https://www.tga.gov.au/summary-supplying-therapeutic-goods-australia.

[44] *Therapeutic Goods Administration. (2017c). TGA post market regulatory activity of complementary medicines—ARGCM Part A: General guidance on complementary medicine regulation in Australia. https://web.archive.org/web/20210508191003/https://www.tga.gov.au/tga-post-market-regulatory-activity-complementary-medicines.

[45] Therapeutic Goods Administration. (2019d). How we regulate medicines. https://www.tga.gov.au/resources/resource/guidance/how-we-regulate-medicines.

[46] *Therapeutic Goods Administration. (2017b). Safety and efficacy information for a new registered complementary medicine—ARGCM Part D: Registered complementary medicines. https://web.archive.org/web/20200413203908/https://www.tga.gov.au/safety-and-efficacy-information-new-registered-complementary-medicine.

[47] *Therapeutic Goods Administration. (2023). Understand the non-prescription medicine pathways—Overview of the type of non-prescription medicines and their application processes. [Text]. Therapeutic Goods Administration (TGA). https://www.tga.gov.au/how-we-regulate/supply-therapeutic-good/supply-non-prescription-medicine/understand-non-prescription-medicine-pathways.

[48] *Therapeutic Goods Administration. (2017a). Advertising of complementary medicines. https://web.archive.org/web/20200413200504/https://www.tga.gov.au/advertising-complementary-medicines.

[49] *Therapeutic Goods Administration. (2018). Australian regulatory guidelines for complementary medicines. https://www.tga.gov.au/sites/default/files/australian-regulatory-guidelines-complementary-medicines-argcm-v8.0.pdf.

[50] *Therapeutic Goods Administration. (2019b). Evidence guidelines Guidelines on the evidence required to support indications for listed complementary medicines. https://web.archive.org/web/20190331071458/https://www.tga.gov.au/sites/default/files/evidence-guidelines.pdf.

[51] Therapeutic Goods Administration. (2019a). Compliance review process for listed medicines. https://www.tga.gov.au/sites/default/files/listed-medicines-compliance-review-process-poster-191127.pdf.

[52] *Therapeutic Goods Administration. (2021). Overview of the regulation of listed medicines and registered complementary medicines. https://www.tga.gov.au/sites/default/files/overview-regulation-listed-medicines-and-registered-complementary-medicines.pdf.

[53] *National Center for Complementary and Integrative Health. Weight Control. NCCIH 2017. https://www.nccih.nih.gov/health/weight-control.

[54] *Or F, Kim Y, Simms J, Austin SB. Taking Stock of Dietary Supplements' Harmful Effects on Children, Adolescents, and Young Adults. J Adolesc Health 2019;65(4):455–61. https://doi.org/10.1016/j.jadohealth.2019.03.005.

[55] County of Los Angeles Public Health. (2018). Learn about Dietary Supplements. http://publichealth.lacounty.gov/hccp/dietarySupplements.htm.

[56] *Food and Drug Administration. (2015). Beware Products Promising Miracle Weight Loss. 1–2.

[57] *Food and Drug Administration. (2019). Questions and Answers on Dietary Supplements. https://www.fda.gov/food/information-consumers-using-dietary-supplements/questions-and-answers-dietary-supplements.

[58] *Pomeranz JL, Taylor LM, Austin SB. Over-the-Counter and Out-of-Control: Legal Strategies to Protect Youths From Abusing Products for Weight Control. Am J Public Health 2013;103(2):220–5. https://doi.org/10.2105/AJPH.2012.300962.

[59] *Pomeranz JL, Barbosa G, Killian C, Austin SB. The Dangerous Mix of Adolescents and Dietary Supplements for Weight Loss and Muscle Building: Legal Strategies for State Action. J Public Health Manage Practice: JPHMP 2015;21(5):496–503. https://doi.org/10.1097/PHH.0000000000000142.

[60] *Rao N, Spiller HA, Michaels NL, Chounthirath T, Casavant MJ, Kamboj AK, et al. An increase in dietary supplement exposures reported to US poison control centers. J Med Toxicol: Off J Am College Med Toxico 2017;13(3):227–37. https://doi.org/10.1007/s13181-017-0623-7.

[61] *Yergaliyev KA, Aveling E-L, Lee RM, Austin SB. Lessons for Local Policy Initiatives to Address Dietary Supplement Use Among Adolescents: A Qualitative Study of Stakeholders' Perceptions. J Adolesc Health 2020;67(4):550–6. https://doi.org/10.1016/j.jadohealth.2020.03.026.

[62] *Federal Trade Commission. (2011, November 1). Dietary Supplements. Consumer Advice. https://consumer.ftc.gov/articles/0261-dietary-supplements.

[63] *Federal Trade Commission. (2018, September 25). Court Rules in FTC's Favor in Case against Weight-loss Supplement Marketer Roca Labs. Federal Trade Commission. https://www.ftc.gov/news-events/news/press-releases/2018/09/court-rules-ftcs-favor-case-against-weight-loss-supplement-marketer-roca-labs.

[64] *Office of the Maine Attorney General. (2016). Attorney General Mills and Federal Trade Commission take joint enforcement action against Maine weight loss pill dealer. https://www.maine.gov/ag/news/article.shtml?id=669043.

[65] *Austin SB, Yu K, Tran A, Mayer B. Research-to-policy translation for prevention of disordered weight and shape control behaviors: A case example targeting dietary supplements sold for weight loss and muscle building. Eat Behav 2017;25:9–14. https://doi.org/10.1016/j.eatbeh.2016.03.037.

[66] Council of Responsible Nutrition. (2023). CRN Testifies Against Proposed Age Restriction Bill in Massachusetts | Council for Responsible Nutrition. https://www.crnusa.org/newsroom/crn-testifies-against-proposed-age-restriction-bill-massachusetts.

[67] Khan, K. (2015). Bill H.3471—An Act regulating the sale of dietary supplements for weight loss or muscle building. https://malegislature.gov/Bills/189/House/H3471.

[68] *Mayer, S. B. (2020). Senate Bill S8089—Relates to establishing restrictions on the sale of over-the-counter diet pills and dietary supplements for weight loss or muscle building. https://www.nysenate.gov/legislation/bills/2019/S8089.

[69] Council for Responsible Nutrition. (2017). CRN Thanks Massachusetts State Legislators for Refusing to Limit Consumer Access to Supplements—Ongoing dialogue by CRN, others, helps stop forward movement of Massachusetts House Bill 3471 | Council for Responsible Nutrition. https://www.crnusa.org/newsroom/crn-thanks-massachusetts-state-legislators-refusing-limit-consumer-access-supplements.

[70] Austin SB, Liu SH, Tefft N. Could a tax on unhealthy products sold for weight loss reduce consumer use? A novel estimation of potential taxation effects. Prev Med 2018;114:39–46. https://doi.org/10.1016/j.ypmed.2018.05.022.

[71] *Government of the United Kingdom. (2021b). The Medicines and Healthcare products Regulatory Agency regulates medicines, medical devices and blood components for transfusion in the UK. GOV.UK. https://www.gov.uk/government/organisations/medicines-and-healthcare-products-regulatory-agency/about.

[72] *Medicines and Healthcare products Regulatory Agency. (2020a). Drug Safety Update—Latest advice for medicines users (14). https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/912231/Aug-2020-DSU-PDF.pdf.
[73] Food Standard Agency. (2019). Do You Sell Or Supply Food Supplements? https://webarchive.nationalarchives.gov.uk/ukgwa/20191207053330/. https://www.food.gov.uk/sites/default/files/media/document/foodsupplementsenglish_0.pdf.
[74] *Government of the United Kingdom, E. (1990). Food Safety Act 1990 [Text]. Statute Law Database. https://www.legislation.gov.uk/ukpga/1990/16/contents.
[75] *Walker M. Food and feed law: Compendium of UK food and feed legislation with associated context and changes during January – March 2017. Energy and Industrial Strategy: Department for Business; 2017. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/617645/Foodfeedlaw_Jan-Mar_2017_v3.pdf.
[76] Government of the United Kingdom. (2021a). 2,4-dinitrophenol (DNP). https://www.food.gov.uk/print/pdf/node/243.
[77] *Government of the United Kingdom. (2020). Stimulant laxatives (bisacodyl, senna and sennosides, sodium picosulfate) available over-the-counter: New measures to support safe use. GOV.UK. https://www.gov.uk/drug-safety-update/stimulant-laxatives-bisacodyl-senna-and-sennosides-sodium-picosulfate-available-over-the-counter-new-measures-to-support-safe-use.
[78] *Medicines and Healthcare products Regulatory Agency. (2020b). New restrictions introduced on sales of stimulant laxatives to counter risks from overuse. GOV.UK. https://www.gov.uk/government/news/new-restrictions-introduced-on-sales-of-stimulant-laxatives-to-counter-risks-from-overuse.
[79] *Medicines and Healthcare products Regulatory Agency. (2020c). Over-the-counter stimulant laxatives: Benefit-risk review. GOV.UK. https://www.gov.uk/government/publications/public-assessment-report-of-over-the-counter-stimulant-laxatives-benefit-risk-review/over-the-counter-stimulant-laxatives-benefit-risk-review.
[80] Hayden L, Brownbill A, Angus D, Nicholas C, Tan XY, Hawker K, et al. Buy now: The link between alcohol advertising, online sales and rapid delivery. Foundation for Alcohol Research and Education 2024. https://espace.library.uq.edu.au/view/UQ:855079d.
[81] *Government of the United Kingdom. The Foods Intended for Use in Energy Restricted Diets for Weight Reduction Regulations 1997. King's Printer of Acts of Parliament 1997. https://www.legislation.gov.uk/uksi/1997/2182/contents/made.