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### **Who are the experts? Examining the online promotion of misleading and harmful nutrition information**

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## CHAPTER TBC

### Who are the experts? Examining the online promotion of misleading and harmful nutrition information.

Dr Heather Horsburgh and Dr David Barron

#### Abstract

There is a proliferation of websites, blogs, and social media accounts focused on providing weight loss, muscle gain, health and fitness information and products. Whilst there are positives to this focus on health and nutrition, the sharing of misinformation is problematic. Even when the information communicated has some supportive evidence and is not wholly inaccurate, the way in which messages are communicated can be harmful. This chapter provides a review of the literature relating to social and psychological harm of nutrition misinformation specifically by applying it to online contexts.

#### Introduction

Navigating the nutrition information environment is not an easy task. When one searches for nutrition information online, they are confronted with conflicting and sometimes dangerous messages. Whilst current official dietary guidelines in the United Kingdom stipulate that most of our daily food intake should come from fruit, vegetables, and starchy carbohydrates, and we should be consuming only small amounts of fish, red and processed meats (Public Health England 2016), there are many other voices communicating information that contradicts these official guidelines. For example, according to one of the most popular diet and exercise programs provided on fitness website *Bodybuilding.com*<sup>1</sup>, one should consume 1.28 grams of protein per pound of lean body weight, and this protein should come from meat, egg whites, fish, and protein powders (some vegetarian options are provided). Thus, a person weighing 180lbs with 20% body fat would have to consume 184g of protein from the above protein sources—the equivalent of about 6 chicken breasts. Another more extreme example comes from one diet that proposes we should ‘Eat 30 bananas a day for 30 days’, which was a suggested nutritional program offered by *Freelee the banana girl*, who has a substantial social media following, and who has described herself as a ‘health YouTuber’. Freelee, receiving much criticism for the highly restrictive and controversial nutrition advice she offers, now promotes a ‘raw til 4’ diet, which suggests eating only raw food until 4pm (Winter 2014; Rudd and House 2018).

The above examples highlight the contradictory information and advice that people can be exposed to online, with some being much more extreme and controversial than others. Some of the nutrition information that people are exposed to is far from healthy, can be dangerous, and, unfortunately, is not a rare occurrence in the world of online personalities offering health and fitness advice to large audiences. The level of harm associated with nutrition

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<sup>1</sup> For information on the training program, see: <https://www.bodybuilding.com/workout-plans/kris-gethins-8-week-hardcore-video-trainer>.

misinformation will depend on the extent of the misinformation and the degree to which the misinformation develops into behaviour. Unfortunately, there are examples where extreme beliefs and behaviours regarding nutrition have led to death. In one such example, Jessica Ainscough, a 30-year-old female who referred to herself as the ‘Wellness Warrior’ on social media, opted to treat her rare form of cancer with Gerson Therapy, which involves a very strict diet of 13 glasses of fruit and vegetable smoothies per day and multiple daily coffee enemas. Ainscough also promoted the diet as a way to treat cancer via her social media platforms (Davey 2015). As a result of opting for Gerson Therapy instead of following the advice of her doctor, Ainscough died in 2015. Despite the tragic circumstances around Ainscough’s death, ‘The Gerson Therapy: The Proven Nutritional Program for Cancer and Other Illnesses’ (Gerson and Walker 2001) is still available on Amazon and, as of 3 April 2019, has 116 reviews and has been rated 4.6 out of 5 stars.

The American Dietetic Association (ADA; now called the Academy of Nutrition and Dietetics or AND) have defined nutrition misinformation (NM) as consisting of ‘erroneous, incomplete, or misleading information without any scientific basis at all. It can be disseminated naively or with malicious or self-serving intent (including to sell products or to gain attention). Food and nutrition misinformation may be harmful to a consumer’s health and general well-being and includes food faddism, health fraud, and misdirected claims’ (in Ayoob, Duyff and Quagliani, 2002: 601). This definition is useful in that it indicates that NM can be communicated naively by people who are interested in—and may or may not trust—the information and want to share it, but can also be communicated with self-serving and sometimes malicious intent. Indeed, there are documented examples of where individuals have communicated NM with the intention of deliberately (fraudulently) misleading consumers. Belle Gibson is one such documented example. Belle Gibson claimed to have cured her own terminal brain cancer through diet and lifestyle, without the help of western medicine. Gibson started a blog to document her journey, which then turned into a business (*The Whole Pantry*), a book deal, and a phone app. In 2015, Gibson revealed that she fabricated the whole story and never had terminal brain cancer (Phillip 2015; Lavorgna and Sugiura 2018). The deliberately misleading and fraudulent information communicated by Gibson is clearly irresponsible in that it has the potential to encourage others to try to treat cancer without science-based evidence.

NM is not a new concept nor one to only affect the online environment. Indeed, the ADA has regularly published their stance on food and NM for over 20 years (Ashley et al. 1995; ADA 2006), while many academics have discussed long-standing issues relating to food marketing and regulation in the offline environment (Nestle 2013; Tempels et al. 2017; Leon and Ken 2019). Nevertheless, there are certain aspects of the online environment that warrant a focused discussion of NM. For example, information creation and exchange in the Web 2.0 environment are different from the traditional media. Specifically, in the online world, two-way communication is possible and potentially anyone with an internet connection and some very basic tech skills can create and share nutrition information with very large audiences who can interact with each other (Ventola 2014; Ma and Atkin 2017). As will be discussed in this chapter, online environments allow companies and individuals to capitalise on sharing erroneous or incomplete information to the public, in the hope of achieving financial, professional, or personal gain.

The aim of this chapter is not to make simplified judgements about what is correct and incorrect nutrition information in online settings—to do so would be to make overly simplistic conclusions of complex nutrition literature, which is something we are being critical of in this chapter and is discussed below. Rather, in delineating the issue of NM by drawing on relevant

psychological, public health, social and life science literature, this chapter highlights how there are too many unqualified voices online advocating many different nutrition protocols, many of which lack scientific evidence. Overall, the present chapter uses examples to show that the problem of NM is not necessarily the inaccuracy of the communicated information (though it can be inaccurate); rather, it has to do with how the information is communicated, who is communicating it, the reasons for communicating it, and the consequences of communicating it. This chapter also highlights the many harms associated with NM and discusses possible methods of tackling the issue.

## **Nutrition misinformation in the online environment**

The internet is the public's main source of diet and nutrition information and seeking health-related information is one of the most common reasons for searching the internet (Jones and Fox 2009; Cash et al. 2015; Ofcom 2018). Moreover, research suggests that people are also tracking and sharing their diet, weight, and exercise routines via social media, blogs, and fitness apps (Fox 2011). This can be to keep track of calorie, nutrient, and activity intake via smartphone applications such as MyFitnessPal, which also has a social media platform where users can share their activity and progress with other users. This ability to engage with nutrition information online is important given that an unhealthy diet is linked to a range of non-communicable diseases such as stroke and a contributing factor in around 20% of global deaths (The Lancet Global Health 2018; WHO 2018). Thus, having access to good nutrition information online arguably can have many benefits, such as informing pro-health behaviours (Cousineau et al. 2008; Cugelman et al. 2011; Pollard et al. 2015).

However, whilst there are many documented benefits of having access to nutrition and health information, concern has been raised over the level of misinformation available to consumers online (Eysenbach and Powell 2002; Wansink 2006; Hausenblas 2015; Ramondt and Ramírez 2019). The level of concern is partly a reflection of the fact that people can model their eating habits based on what they are seeing online (Cruwys et al. 2015; Higgs 2015). Higgs (2015) argues that we may choose to model the eating behaviour of others due to motivations to be part of a group and to feel liked/accepted. Another reason proposed by Higgs states that people model eating behaviour for informational purposes (knowing what constitutes 'correct' eating behaviour). Here, people seek guidance from others to fill an information void and to increase self-efficacy, and they model behaviour they see because they want to reduce the uncertainty they feel (Morahan-Martin 2004; Cruwys et al. 2015). Further, Lambert and colleagues (2019) found that participants did not follow official dietary guidelines because there is no sense of urgency; focusing on long-term reduction of risk factors is something that their participants would worry about later in life. Instead, participants were likely to follow what they see on social media because they want a particular body image (see also **chapter N**). Females, in particular, were prone to thinking that if they wanted to look like people they see on social media and in advertisements then they need to eat like those on social media. Further still, there is evidence to suggest that people are more likely to follow the eating norms of a group if they find that group aspirational (Englis and Solomon 1995; Cruwys et al. 2015). There is also limited research to suggest that a range of moderating factors may influence whether someone models the behaviour of others, including age (young), weight (overweight), personality (impulsive), and (low) self-esteem; these moderating factors are strongest when looking at the interaction between participant and model (e.g. eating behaviour is likely to be modelled if participant and model are of similar age or weight; Bevelander et al. 2013; Cruwys et al. 2015).

## **Fad diets and social media trends**

Two interrelated ways that NM can flourish online and reach so many people is through social media trends and the promotion of fad diets.

### ***The convincing presentation of the fad diet***

Fad diets such as low-carb/high fat diets (LCHF, e.g., the Atkins Diet), the Paleo diet, the Cabbage Soup Diet, and the Raw Food Diet typically promise speedy weight loss results, involve eating a restrictive diet that bans certain foods, may involve the addition of certain ‘magical’ fat burning foods, or involve taking large quantities of supplements (Porter 2017). Whilst some of these diets have more support than others from the scientific literature (for instance the LCHF diet, Foster et al. 2003), all lack sufficient scientific backing in terms of their effects on various health markers (e.g., weight) over longer periods of time (Kuchkuntla et al. 2018). Further, all fad diets promote NM in the sense that they contradict established and official dietary guidelines; they are ineffective, heavily restrict people’s eating habits, or simply are not sufficiently supported by scientific research (Klein et al. 2003; Kuchkuntla et al. 2018). Proponents of various diets have also been accused of sensationalising and making unsubstantiated claims about a diet, food, or supplement (Rousseau 2015). For example, Tim Ferriss, who is a popular and influential American author, blogger, and entrepreneur publishes podcasts on a variety of topics relating to health and self-improvement. In 2015, Ferriss aired a podcast with Dr D’Agostino, Associate Professor in Molecular Pharmacology and Physiology. The Podcast was titled *Dom D’Agostino on Fasting, Ketosis, and the End of Cancer* (Ferriss 2015). In this podcast Ferris and Dr D’Agostino discuss how a ketogenic diet can be used to kill cancer cells. The title of the podcast is clearly misleading, and the podcast presents a one-sided and overly simplistic view of the very complex topic of linking diet to cancer treatment. Indeed, in follow-up interviews, Dr D’Agostino apparently conceded that the title of the podcast is ‘unfortunate’ and that, whilst a ketogenic diet can kill or slow down the growth of some cancer cells, it can speed up others (Easter 2019).

Even if the evidence were to support the benefits of a LCHF diet for all outcomes (i.e., not just weight loss, but other health indicators such as blood pressure and insulin resistance), the way that this diet is promoted online is often filled with misinformation and unhealthy advice (Mann et al. 2014; Holmberg 2015). For example, an internet search for the ketogenic diet (an LCHF diet) brings up many images of processed meats, which are not exactly healthy; in fact, processed meats have been declared carcinogenic by the World Health Organisation (Bouvard et al. 2015). Similarly, popular versions of the LCHF diet such as the Atkins Diet discourages the consumption of many fruits, vegetables and wholegrains, which contradicts most official nutrition guidelines and many current studies relating to fibre consumption, gut health, and health outcomes (Dahl and Stewart 2015). Thus, whilst the LCHF might achieve weight loss and can be adopted relatively healthily, the messages that are often communicated in the promotion of such diets can be misleading, contradictory, and unhealthy.

One of the reasons the fad diet is able to flourish online is that communicators generally provide an overly simplistic argument and refuse to include a full and accountable discussion of the scientific evidence, which is often contradictory and changes frequently. Rousseau (2015) gives the example of comedian Dara O’Briain in 2009 saying that one way to spot pseudoscience is that it claims certainty where none exists and that science, on the other hand,

‘knows it doesn’t know everything. Otherwise it would stop’ (O’Brian 2009). Further, fad diets also often fail to stipulate the objectives or desired outcomes of those diets, which can add to the confusion of deciding whether a particular diet is right for you. Indeed, ‘Eating well’ means different things, depending on the approach you take. For example, whether our priority is the environment, animal welfare, body fat, blood glucose levels, inflammatory markers, agriculture, or general physical health, will all determine what it means to eat well. That is, eating well will mean different things in each of these contexts (Jackson 2017).

The complexity of nutrition science-based evidence and the attractive simplicity of the messages provided by many of the non-experts offering advice online has meant that a misleading, overly simplified message that is not backed-up by evidence, but by testimonials and often endorsed by celebrities, is becoming the new trusted source for those looking for quick and effective solutions to their health and weight-related problems (Ayoob et al. 2002; Rousseau 2015). This situation, where essentially anyone can dish out nutrition advice and can do it in a more accessible or convincing way than scientists or official sources of information, is leading to a crisis of authority (Wansink 2006; Belasco 2013; Holmberg 2015). Specifically, when online sources of information can make themselves seem credible, generate a coherent and focused argument, and use motivating examples as evidence, consumers (at least some of them) are led to question the legitimacy of official sources of nutrition information, which are often contradictory (Holmberg 2015; Rousseau 2015).

### ***#Trends***

In addition to the online promotion of specific diets that are potentially harmful to consumers, online platforms like social media encourage the formation of lifestyle trends. By way of example, *#thinspiration* (a combination of the words thin and inspiration) and *#fitspiration* on social media platforms such as Instagram, Twitter, and Facebook, are two main trends that are discussed here in order to demonstrate how nutrition misinformation can flourish and how it can be harmful. Indeed, one mechanism through which nutrition misinformation can spread rapidly to large audiences is through the hashtag (#)—a convenient and organised way for people to read about topics that follow a specific theme. Further, social media and websites make it easier for trends to form because they create a situation where people can easily seek information that confirms already held beliefs. This can be a strong facilitator of trends, where one can not only find information that acts as confirmation of one’s opinions, but one can also seek other people to interact with in real-time who share those same beliefs, thus reinforcing those beliefs even further (Wansink et al. 2014).

Each trend discussed here have implications for the nutritional knowledge and behaviours of the public, with some communicating extremely harmful information. Furthermore, they have in common the fact that they typically involve people posting pictures of themselves and sharing information about their daily eating and exercise habits in order to inspire others. For example, *#thinspiration* (which is closely associated with the pro-anorexia movement) promotes pro-anorexic beliefs and behaviours, and heavily suggests that eating disorders are not an illness but rather a lifestyle choice (Fox et al. 2005; Boero and Pascoe 2012; Crowe and Watts 2016; Talbot et al. 2017). Worryingly, a quick Twitter search of *#thinspiration* brings up many tweets from people, mainly young women, posting pictures of themselves in order to inspire others to aim for a level of thinness that can only realistically be achieved by adopting behaviours associated with eating disorders (Fox et al. 2005). Some give tips on how to suppress hunger, such as taking up smoking, followed by hashtags such as *#ihatemyself*.

Further, searching Instagram for the term *thinspo* also brings up many worrying posts related to diet and lifestyle choices, where people share their extreme diets (often involving very little food or encouraging purging after eating) and seek encouragement for their behaviour.

Similarly, *#fitspiration* is a current social media trend that promotes images of individuals who look exceedingly fit, with toned, muscular bodies. The idea is to inspire people to maintain a healthy lifestyle, with a significant focus on physical activity and eating to achieve and maintain an athletic body (Hausenblas 2015). There is research to suggest that the fitspiration trend promotes more positive images and a healthier lifestyle than its thinspiration counterpart (Talbot et al. 2017). This is due in part because one presumably needs to actually eat some food and engage in physical activity to achieve the type of fit/athletic image that is being celebrated. There is also some evidence to suggest that fitspiration is also more popular than thinspiration (Simpson and Mazzeo 2017). However, research has demonstrated that despite claiming that health and fitness is the goal being projected in fitspiration posts, it is actually attractiveness, and subsequently thinness, that is the primary objective (Simpson and Mazzeo 2017). Indeed, it just takes a quick search for 'fitspiration' on social media sites like Pinterest and Instagram and you will be confronted with images of extremely and sometimes worryingly thin women. Of course, all of this gives the impression that one should exercise and eat to maintain a desirable appearance rather than to maintain one's physical and mental health (Carrotte et al. 2017). As a result, nutrition misinformation is rife in these environments, with many unqualified people sharing diet advice, based on the latest fad diets (Villiard and Moreno 2012). Similarly, pro-muscularity websites, blogs and forums, provide an intense focus on building muscular bodies, and offering dietary guidelines to achieve them (Murray et al. 2016). Like fitspiration, the communication of bodybuilding information initially seems relatively healthy. However, research suggests that the content of pro-muscularity websites displays characteristics and behaviours that are very similar to the characteristics of eating disorders; for example, periods of highly restrictive eating with periods of bingeing on a lot of food, which is often unhealthy (Mosley 2009; Murray et al, 2012, 2013, 2016).

### **The culprits: sharers of nutrition misinformation online**

The sharers of NM online are varied, ranging from people who are deliberately sharing misinformation in an attempt to gain publicity and economic/professional gain (e.g., Belle Gibson, discussed above) to regular consumers of information who either share it because they believe the information is true or who share it because they think others will find it interesting (Chen et al. 2015). The next section highlights some of the most common types of sharers of NM.

### ***The health and fitness industry and the rise of the micro-celebrity***

In the nutrition and fitness sector, there is a proliferation of entrepreneurs and personalities using the online environment to market products and services. Indeed, industry plays a significant role in the growth of the online marketing of nutrition information, as food and supplement companies adopt a wide range of social media strategies to promote their products to consumers (Belz and Schmidt-Riediger 2010; Holmberg 2016). For example, whilst they engage in direct marketing campaigns on social media (Strom 2011), companies can also distance themselves from their own marketing campaigns by employing or sponsoring individuals to advertise their products online. For instance, Optimum Nutrition, a popular

supplement company offering a range of protein, sport, and health supplements, sponsor ‘athletes’ to promote their products. These sponsored athletes, according to the Optimum Nutrition website, have a range of different professions, including bodybuilding, modelling, and ‘influencer’—the latter, having a rather ambiguous relationship to the word athlete. Typically, the sponsored ‘athletes’ for supplement companies and food brands already have an established social media following and are paid to continue their usual social media activities while occasionally promoting the product they are being paid to promote.

Celebrities and healthy-living bloggers, too, are paid by supplement and food companies to advertise products online. Typically, healthy-living bloggers maintain an internet presence as a way to document and share their daily activities and behaviours, in the hope of inspiring or showing others how to live a similar lifestyle (Boepple and Thompson 2014). Social media influencers who have more than 100,000 followers can be paid up to £4,000 for a single post that advertises a product or company, while this can rise to £230,000 for a YouTube video if the person has 7 million followers or more (O’Connor 2017).

The advancement of Web 2.0 and this culture of paying people for having a large social media following has resulted in the rise of the micro-celebrity (i.e., people who become famous because of their social media presence). Certainly, there is a documented rise in self-branding, where individuals can develop a distinctive public image in the hope of attracting financial, professional, or social capital gain (Khamis et al. 2017). In this environment, it is easy to see how misinformation, and by extent, harmful advertising, can proliferate. Indeed, there are many recent examples where personalities have been attracting attention from the Advertising Standards Authority (ASA) for providing misleading advertisements, and those being investigated are only the tip of the iceberg (Tait, 2019). One example is provided by a reality TV star posting a photo of herself on Instagram looking like she is about to eat a burger and fries. The photo was accompanied by the text: ‘Always take my @ProteinWorld<sup>2</sup> Carb Blockers Before a Cheat meal, contain natural ingredients and stop any unused sugars being used as fat #ad’ (Calvert 2018). The ASA ruled that the advert—and others like it posted by other celebrities around the same time—was misleading and gave the impression that consumers could eat high carb foods and not worry about storing fat.

It is not just micro-celebrities and reality TV stars who attract criticism for their endorsement of diets and nutrition products. Hollywood actress turned wellness guru—Gwyneth Paltrow, for example—has developed a lifestyle brand, *Goop*. Through this brand, Paltrow has attracted criticism for promoting highly restrictive diets, as the following quote indicates: ‘I see patients suffering with anorexia nervosa and now I’m reading their diet in pamphlet form’. This is a statement made by Catherine Collins, a dietician at St George’s hospital, London (cited in Wilcox 2011). The concern is in reference to a diet that severely restricts the number of foods one can eat and results in dieters exercising for around 2 hours per day whilst often eating fewer than 700 calories per day (Wilcox 2011). According to Wilcox, who tried the diet and documented the process, the first week of the diet recommends that dieters eat only 7 different foods (mostly vegetables, with a little protein), and most of this should be blended. Having reviewed the diet that Wilcox is following, Collins says: ‘The lack of absorbable calcium means you risk early onset osteoporosis and osteopenia—something that Gwyneth Paltrow has been diagnosed with’.

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<sup>2</sup> Note, the @ symbol preceding the target word, in this case ProteinWorld, gives the user a direct link to the company.

## **Harm caused by nutrition misinformation**

This section addresses some of the main potential outcomes consumers are faced with when regularly exposed to fraud and misinformation of this nature.

### ***Psychological harm***

The psychological harms which may be incurred from NM can cause negative emotions amongst users. Indeed, psychological consequences from NM may also result in a distorted view of body image (Croll 2005). When consumers are constantly shown images of models who are of a specific body image (e.g., 'positively' thin, or 'negatively' large), they are prone to experience a sense of peer pressure to abide by these standards (Dunkley et al. 2001). Hence, this leads them to adhere to specific diets, and may experience feelings of intense discontent towards their own body image if the misinformation causes opposite effects to happen. Indeed, there is a growing body of research that suggests that social media trends such as fitspiration and thinspiration can affect mood, self-esteem, and body dissatisfaction (Tiggemann and Zaccardo 2015; Holland and Tiggemann 2016; Prichard et al. 2018). Of course, the outcome of this can lead to eating disturbances; these include, but are not limited to, anorexia and bulimia nervosa (Juarez et al. 2012; Saunders and Eaton 2018).

Further, there is evidence to suggest that the prevalence of trends such as raw food diets, clean eating, and the promotion of food fear have resulted in dramatic increases of Orthorexia Nervosa (ON), which received proposals for specific diagnostic criteria in 2015 for the first time (Santarossa et al. 2019). ON refers to disordered eating behaviour generated by a compulsive obsession for biologically pure and healthy nutrition (Morozé et al. 2015), going as far as avoiding food that has been sliced/prepared a certain way or foods that have any 'undesirable' components, such as fat or sugar. Those suffering from ON often face extreme dietary restrictions, social isolation, and malnutrition (Morozé et al. 2015).

In addition, unnecessary feelings of guilt and self-blame may be present in cases where one does not abide to the food misinformation diet which are assumed to be correct (Harrison 2012). In many cases, diets are unsustainable and individuals who are unable to lose weight in a short amount of time may feel resentment and anger towards their bodies (Raggat et al. 2018). This can result in social isolation from peers due to frustration and mood swings from feeling dissatisfied with one's body image (Smith-Jackson et al. 2011). Those who are regularly exposed to this type of information may feel inadequate in their perceived ability to confidently manage a healthy lifestyle, thus being more susceptible to following misinformation (Ayoob et al. 2002). In addition, consumers of frequent misinformation may fall into depression upon finding out that they were being scammed and their health goals were not met (Khawandah and Tewfik 2016).

### ***Physical harm***

Physical harm which may occur from NM can include deterioration in health and sickness. For instance, there may be toxic components in foods or supplements which can cause severe sickness and adverse reactions to the body, such as sports mixtures that cause gastrointestinal

discomfort (Brouns et al. 2002). This situation has been exacerbated by the online environment, which also enables people to purchase products that are not legally sold in the consumer's country of origin (e.g., slimming pills not approved for sale in a consumer's country). This unregulated trade has led to significant physical harm to the consumer, with a fatality being a possible outcome. One such example is the death of Eloise Parry, a 21-year-old British student who suffered from bulimia. Eloise bought diet pills online and became addicted to the chemical components of the pills. Three people from London went on trial for manslaughter after buying chemicals from China and manufacturing the pills in their London flat (BBC 2018).

Further, for the average consumer as well as athletes, there are clear health implications for the copious amounts of supplement products that are marketed towards those wishing to improve their physical performance, their body, and their general physical and mental health. Indeed, many of the online marketed products contain ingredients that could be considered unhealthy. For example, large amounts of artificial flavours and sweeteners, and many heavy metal contaminants such as lead, arsenic, and mercury are a known problem in supplements (Ernst 2002; Saper et al. 2008).

In addition, NM can cause the development of unhealthy eating habits and diet (Harrison 2005), which has direct implications for physical health. For example, NM may result in a number of serious weight issues, including the possibility to fall into levels of obesity, which can lead to heart attack, liver failure, and mobility issues (Harrison 2005; Raggatt et al. 2018). On the other hand, rapid weight loss may also occur due to the lack of nutrients (Khawandah and Tewfik 2016). In addition, the 'yo-yo' effect (weight loss and weight gain in a short time) may lead to cardiovascular disease, renal dysfunction, and osteoporosis (Khawandah and Tewfik 2016). Taken together, these weight issues may lead to a decreased quality of life, with an increase in early mortality.

### ***Economic harm***

The main economic harm from nutrition misinformation comes from unnecessary financial expenditure by consumers, by paying for ineffective or unnecessary diet and health products (British Nutrition Foundation 2015; Manning and Soon 2016). This may be particularly problematic for those from a lower socioeconomic background, leading to serious financial turmoil. For example, trends such as gluten free, organic, dairy free require the purchasing of alternative products that are more expensive; thus it has been advised by the British Dietetic Association that any diet promoting those expensive food alternatives should only be followed if there is a diagnosed medical reason to do so (Porter 2017).

A further example of the economic cost of the promotion of various misinformation in supplements come from the fact that protein powders are now painted as a necessity for anyone wishing to gain muscle and lose fat. There are many examples of people who are sponsored by supplement companies suggesting that it is imperative to consume a protein shake immediately after your workout. For example, Shaun Stafford, who is an Optimum Nutrition sponsored athlete, is frequently posting on Instagram about how imperative it is to take a quality protein supplement. When doing a question and answer session on Instagram in October 2018, Shaun was asked how he recovers from workouts, to which he responded: 'When it comes to recovery, it is *really* important for your diet to be on point. This means not only the food you are eating, but also the sports nutrition you are using. So, for me, Gold Standard Whey is a key part of that'.

## Further discussion and conclusion: from misinformed to informed

A central component of the argument set out in this chapter is that NM has been able to flourish in the online environment because evidence-based nutrition evidence is complex and difficult to understand by the public (Goldberg and Sliwa 2011). This, along with the accessibility of Web 2.0, has created an opportunity for many different voices to communicate nutrition information to large audiences. Many of these voices are unqualified, presenting erroneous, biased, or fraudulent information to consumers. This is problematic because NM is associated with psychological, physical and economic harms. The number of conflicting, sometimes erroneous, and often convincing messages that consumers are exposed to has led to concern over whether consumers are experiencing information overload, which may result in people making poor nutrition decisions (Ramondt and Ramírez 2019).

In addition to encouraging fact checking by consumers (Chen et al. 2015), those who communicate NM should be encouraged to provide a more balanced and measured representation of the nutrition evidence. One way to do this is through the regulation of the way industry and individuals advertise products and services, both online and offline (Nestle 2013; Tempels et al. 2017; Leon and Ken 2019). Ensuring adverts are not misleading or harmful currently falls under the remit of the ASA in the United Kingdom and, whilst they have been active in investigating complaints against those communicating misinformation, they have been able to have only a minimal impact (Tait 2019). It is not only in relation to advertisements that regulation could be improved. As indicated, there is an observed problem of weight loss and nutrition supplements either containing harmful ingredients or containing such poor-quality ingredients that they are ineffective. Therefore, in order for the nutrition information environment to be safe, there needs to be fundamental changes in the way that food and supplements are produced and marketed.

Addressing the problem of how NM is instantaneously communicated online to many people is imperative given that social influence, eating norms, and personal factors such as self-esteem all play a significant role in determining what people eat (Bevelander et al. 2013; Higgs 2015). Because of this, it is vital for there to be more positive and healthy role models accessible online and capable of engaging with audiences to the same extent as their less healthy counterparts. Luckily, there are some qualified medical and dietitian professionals who have developed a substantial online presence and are using their influence to improve health: *The Doctor's Kitchen* and the *Gut Health Doctor* are two examples of this. This is important because if there are more qualified professionals who can generate a significant social presence—and can communicate accurate and healthy messages to their audience—then this might work to reduce the crisis of legitimacy experienced by official sources of nutrition information (Holmberg 2015; Rousseau 2015). It may also help to reduce the psychological, physical, and economic harms associated with nutrition misinformation.

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