

Power on the Plate

How Industry Upholds Consumption of Animal Products

Ben Colin Matthies

Master Thesis Series in Environmental Studies and Sustainability Science,
No 2017:008

A thesis submitted in partial fulfillment of the requirements of Lund University
International Master's Programme in Environmental Studies and Sustainability Science
(30hp/credits)



LUCSUS

Lund University Centre for
Sustainability Studies



LUND
UNIVERSITY

Power on the Plate

How Industry Upholds Consumption of Animal Products

Ben Colin Matthies

A thesis submitted in partial fulfillment of the requirements of Lund University
International Master's Programme in Environmental Studies and Sustainability Science

Submitted May 16, 2017

Supervisor: Elina Anderson and Genesis Tambang Yengoh, LUCSUS, Lund University

Abstract

Background: Current consumption levels of animal products (APs) are unsustainable but measures to reduce their consumption are lacking. Simultaneously, APs are widely perceived as healthy which hinders their substitution with other foods. The AP-industry might influence AP consumption as they have the necessary financial means, the interest and the organizational capacity.

Objective: To investigate how the AP-industry influences AP consumption. The focus lays on hidden industry-influence concerning political regulations and health perceptions of APs.

Methodology: Three cases exemplify industry-influence on regulations and one case on science and media concerning health. Building on the last case, a systematic science review was conducted to test whether the AP-industry influences science. Moreover, a media review investigated the prevalence of industry-influenced-studies in popular online articles. The analyses of all cases and reviews is framed by Lukes' theory of power. More specifically, the concept of Doubt-Making guides the analyses of the most hidden form of power.

Results: Three cases revealed that the AP-industry uses lobbying and lawsuits as well as influence on key decision-makers to prevent regulations. The other case suggested an influence on science as well as popular media. This was confirmed by the science review which showed that industry-studies were significantly more likely than independent studies to show conclusions favourable to the AP-industry. Furthermore, the media review indicated that industry-influenced-studies do support popular articles that are in favour of APs. In addition to influencing content, the AP-industry is shifting the health debate to nutrients and away from deadly diseases.

Discussion: Industry-influence on science and media improves people's health perceptions about APs leading to higher consumption. Moreover, retarding regulations keeps APs available and at low costs which increases consumption too. Additionally, the AP-industry uses advertisement and communication techniques that further enhance AP consumption. Thereby, AP consumption reaches unsustainable high levels which increase the financial means of the AP-industry. Thus, the AP-industry becomes more powerful and therewith even more effective. Hence, for reducing AP consumption, politicians, consumers, health advocacies, scientist and civil society should collaborate to lessen industry-power. Sustainability Science could play an important role in connecting this potential alliance of actors.

Conclusion: The AP-industry upholds consumption by fighting regulations through lobbying, lawsuits and influence on key decision-makers. Moreover, industry influences health perceptions by supporting science that later fosters favourable media articles. Actors that strive for reducing AP consumption should take those industry strategies into account.

Keywords: funding effect, meat, doubt, sustainability, lobbying, media reporting

Word count: 13 93

Acknowledgements

First, I thank all researchers and journalists that made this thesis possible. Special thanks go to the team of the nutritionfacts.org website that made scientific studies related to the saturated fat case and the health background more easily accessible. Moreover, I thank Elina Anderson, Genesis Tambang Yengoh, Oliver Watson, Renee Jens, Julia Schrader, Sophia Rabien and Kai Wagner for providing critical feedback – meaning of course it was critical for the development of this thesis.

Table of Contents

1	Introduction: Animal Products, Health and the Industry	7
1.1	Sustainability concerns of animal products	7
1.2	The AP-industry: well organized with financial power	9
1.3	Regulations are potential targets of industry-influence	9
1.4	The AP-industry might target science and media related to health.....	9
1.4.1	<i>Industries do fund studies but research regarding influence is inconclusive</i>	11
1.4.2	<i>Potential influence on media through industry-studies</i>	12
1.4.3	<i>The importance of influencing health debates</i>	12
1.5	Disposition: from theory to solutions	13
2	Theoretical Framework: Power and Doubt-Making	14
2.1	Power according to Lukes	14
2.2	Doubt-making: the tobacco-style	15
3	Methodology of Cases, Science and Media Review	17
3.1	Exploratory cases of industry-influence.....	17
3.2	Quantitative methods investigating industry-influence on science and media.....	17
3.3	Science review: industry-influence on papers concerning meat.....	18
3.3.1	<i>Questions and overview</i>	18
3.3.2	<i>Search procedure</i>	18
3.3.3	<i>Criteria regarding sub-question 2a</i>	19
3.3.4	<i>Criteria to answer sub-question 2b</i>	20
3.3.5	<i>Categorization procedure</i>	21
3.3.6	<i>Statistical analysis.....</i>	22
3.3.7	<i>Limiting factors: single researcher, broad search and simple categorization</i>	23
3.4	Media review: debates and industry-papers on web pages	24
3.4.1	<i>Method to categorize meat-debates in media</i>	24
3.4.2	<i>Method to evaluate the prevalence of industry-studies in media</i>	25
3.4.3	<i>Missing reference points as a limitation</i>	26
4	Findings: Industry-Influence on Regulations, Science and Media ...	27
4.1	Cases of AP industry-influence on regulations.....	27

4.1.1 <i>Influencing key decision-makers: meat Safety and the USDA</i>	27
4.1.2 <i>Big scale lobbying: the Multiple Traffic Light System in the EU</i>	28
4.1.3 <i>Winning the public debate: The Danish fat tax</i>	29
4.1.4 <i>Power over regulations: summarizing the first three cases</i>	30
4.2 AP-influence on science and media related to health	31
4.2.1 <i>“Butter is back” – shaking up the saturated fat debate</i>	31
4.3 Industry-studies are more likely to show conclusions in favour of meat.....	34
4.3.1 <i>Different study designs may be the main reason for diverging conclusions</i>	36
4.4 Meat-debates in media: strong emphasis on nutrients.....	38
4.5 Industry-studies are prevalent in media	39
5 Discussion: The Big Picture of Industry-Power and Reflections	41
5.1 The role of industry-influence for AP consumption	41
5.2 The potential of the theories, mixed methods and Sustainability Science.....	43
6 Solutions: Reducing Industry-Power and Animal Product Consumption	45
7 Conclusion	48
References.....	49
Appendix: Search Terms.....	60

1 Introduction: Animal Products, Health and the Industry

1.1 Sustainability concerns of animal products

Current consumption levels of animal products (APs) such as meat, dairy and eggs are a threat to sustainability. First, livestock cause greenhouse gas emissions reaching between 14.5 and 18% of total global emissions – more than the whole transportation sector (Gerber et al., 2013; Gill, Smith, & Wilkinson, 2010). Hence, reducing AP consumption is unavoidable for achieving climate targets (Hedenus, Wirsenius, & Johansson, 2014). Second, livestock drives biodiversity loss as new grazing land and feed production are the most important drivers for habitat destruction (Machovina, Feeley, & Ripple, 2015). Third, energy and land requirements are considerably higher for APs compared to plant-based products (Cassidy, West, Gerber, & Foley, 2013). Hence, 4 billion additional people could be fed if all APs were abandoned, but also gradual dietary shifts would considerably enhance available calories (Cassidy et al., 2013). Thus, current levels of AP consumption are unsustainable regarding food security, biodiversity and a stable climate.

Some forms of animal husbandry can provide environmental services but those could be maintained while reducing AP consumption. Manure for example can substitute energy-intensive, chemical fertilizers (Dawson & Hilton, 2011). However, nitrogen and phosphorus from animal production systems are contributing to pollution of water bodies that can result in coastal hypoxic zones (Diaz & Rosenberg, 2008; Girard, Nikiema, Brzezinski, Buelna, & Heitz, 2014). Hence, manure production is too high in many areas. Another example of desirable animal husbandry is grazing of sheep for vegetation control (Ross et al., 2016). Yet, while such measures require only few animals, overgrazing is a risk in some places (Ross et al., 2016). As an example: if Europe would cut its AP consumption in half, land requirements would decline by 23% and nitrogen emissions by 40% (Westhoek et al., 2014). Therefore, lower AP consumption is desirable since it would reduce negative impacts while sustaining the advantages of animal husbandry.

However, despite those potential benefits neither consumers nor politicians strive for reductions across the board (Dagevos & Voordouw, 2013; Popkin, 2011). Meat consumption is on the rise globally and only moderately declining in industrial nations (Vranken, Avermaete, Petalios, & Mathijs, 2014). In many countries, the AP-industry profits from tax reductions and subsidies rather than facing financial penalties (Stoll-Kleemann & Schmidt, 2016). In developed nations alone, APs are supported with \$52 billion of subsidies (Chemnitz & Becheva, 2014).

Some authors have suggested cultural and psychological reasons for this discrepancy as meat-eating strengthens social ties by displaying confirmative behaviour (Higgs, 2015). Moreover, it is a way to display masculinity and potentially impress others (Stoll-Kleemann & Schmidt, 2016). Nowadays, meat is widely regarded as indispensable for proper meals and its consumption became a cultural norm (Stoll-Kleemann & Schmidt, 2016).

I agree with those reasons but doubt that they are sufficient. Therefore, I focus on the mechanisms and structures that drive AP consumption especially power-issues. As I show in chapter 1.2, the AP-industry may try to uphold AP consumption. Hence, aiming to explain the discrepancy between negative environmental impacts and high consumption, I ask: **how does the AP-industry influence AP consumption?** At that, I consider only industrial and emerging nations. Small-scale animal production in the Global South is less problematic for the environment but potentially important for food security (Herrero et al., 2013). In contrast, APs are largely unnecessary for nutrition in the Global North¹. Sub-questions of the research question are:

1. Through which mechanisms does the AP-industry influence regulations?
2. To what extent is the AP-industry influencing science and media related to health?
 - a) Are industry-studies more likely to show conclusions in favour of meat?
 - b) How do industry and independent studies differ regarding design and discussed issues?
 - c) Which issues are predominantly discussed in popular media related to meat and health?
 - d) How often do industry-studies support favourable media articles about meat and health?

Industry-studies constitute a major role for this research. I define industry-studies as scientific papers that are facilitated by funding of the AP-industry or characterized by authors relations with the AP-industry. Put technically, industry-studies equal the *high influence*-category in chapter 3.3.6. Anyhow, figure 1 illustrates how the sub-questions are linked. The next sections explain why I chose the sub-questions and focus on the AP-industry.

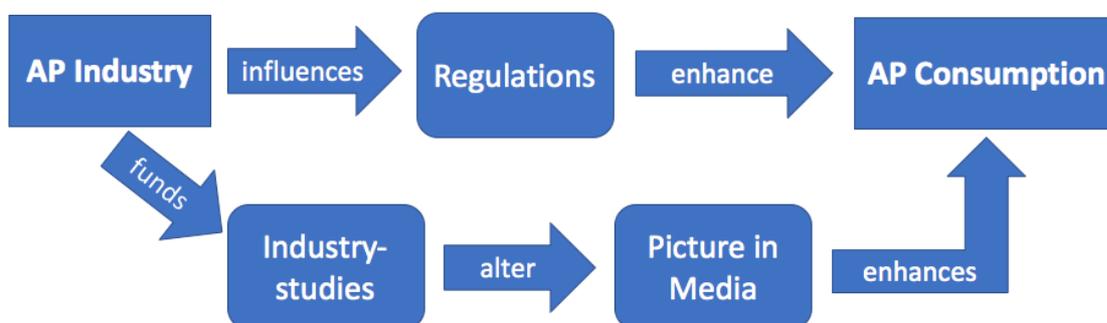


Figure 1. showing how the AP-industry might influence AP Consumption.

¹ If supplemented with vitamin B12, even completely abandoning APs may be advantageous regarding nutrition and several risk factors compared to a western-style diet (Fontana, Meyer, Klein, & Holloszy, 2007; Kwok et al., 2012; Rizzo, Jaceldo-Siegl, Sabate, & Fraser, 2013).

1.2 The AP-industry: well organized with financial power

When following the money from the purchase of an AP upstream, certain industries gain profits. There are animal-farmers, processing industries such as dairy factories or slaughterhouses and pharmaceutical companies that depend on people consuming APs (Joy, 2011, p. 38). Joy (2011) estimated that business with APs accounts for \$125 billion in the US alone and this creates high stakes for upholding AP consumption (p. 38). Moreover, AP-industries founded overarching organizations such as the *International Dairy Foods Association* for effectively defending their interests. In contrast, the fruits and vegetables producers are less well organized since different plant-growers compete with each other (Nestle, 2013, p. 131). Grain producers are also unlikely to form a strong counterweight since, for example, in the US 67% of crop calories are fed to animals (Cassidy et al., 2013). Perhaps the only food sector with more power is the sugar/processed-food industry and we see some interactions with this sector in chapter 4. Minding this exception, the AP-industry has financial interests in upholding consumption and a greater organizational capacity than other food producers. Hence, the AP-industry may try to increase AP consumption and is therefore in the focus of this research.

1.3 Regulations are potential targets of industry-influence

Cuts in subsidies or regulations that would raise prices of APs are threatening industry-profits since AP consumption would likely decline (Gallet, 2010; Säll & Gren, 2015). Hence, the AP-industry has an interest to fight regulations just as other industries frequently do in such cases (Stuckler & Nestle, 2012; Withana et al., 2012). Therewith, industries are often successful since they can threaten to shift production elsewhere (WBGU, 2011). Furthermore, industry-organizations outplay civil-society organizations in terms of financial resources (WBGU, 2011). Thus, fighting regulations seems common practise among industries in general and the AP-industry has the interest to do so. Therefore, I ask sub-question 1: through which mechanisms does the AP-industry influence regulations?

1.4 The AP-industry might target science and media related to health

Sustainability concerns of APs are great but health may be a more important motivator for people's food choices. Especially for older vegetarians health aspects outweigh environmental concerns (Pribis, Pencak, & Grajales, 2010) and they are the main reason for flexitarians to reduce AP consumption (De Backer & Hudders, 2014). After ethical arguments, health-messages were the second most effective at reducing meat consumption among Germans (Cordts, Nitzko, & Spiller, 2014). Additionally, health is a controversial topic which might make industry efforts in this area

more effective. Therefore, the AP-industry may try influencing health perceptions if necessary and as the following paragraphs show: it is necessary.

As health is important, APs are potentially in trouble since some science shows negative health implications of APs. To illustrate that, I present several critical studies without aiming for a complete picture. One potentially problematic issue are APs' contents of saturated fat, cholesterol and trans-fats which may lead to heart disease (Roberts, 2010; Trumbo & Shimakawa, 2011). This general link was specifically confirmed for eggs, processed meat and fat-rich dairy products (Kaluza, Åkesson, & Wolk, 2014; Nettleton, Steffen, Loehr, Rosamond, & Folsom, 2008). Likewise, animal fats may cause diabetes (Forouhi et al., 2014) potentially leading to a 74% higher risk for meat-eaters compared to vegetarians (Vang, Singh, Lee, Haddad, & Brinegar, 2008). Furthermore, a meta-analysis suggests higher diabetes risk through egg consumption (Li, Zhou, Zhou, & Li, 2013). Regarding cancer, both red meat and eggs may be cancer promoting with processed meat being the most dangerous (Bouvard, Loomis, Guyton, Grosse, Ghissassi, et al., 2015; Craig, 2009; Nettleton, Diez-Roux, Jenny, Fitzpatrick, & Jacobs, 2008). In total, APs may increase mortality-risk and even moderate reductions in consumption could be life-prolonging (Martínez-González et al., 2014).

Besides death, APs may cause disabilities as purines from animal protein are linked to Arthritis (Hailu, Knutsen, & Fraser, 2006). Moreover, milk may promote acne by elevating growth hormone levels (Yang et al., 2010; Zhao et al., 2011; Zhu, Ioannidis, Li, Jones, & Martin, 2011) and increase hip-fracture risks despite containing much calcium (Bischoff-Ferrari et al., 2011; Michaëlsson et al., 2014). Lastly, elevated cholesterol levels can also clog the blood vessels in the penis potentially leading to erectile dysfunction (Jackson, 2012; Montorsi, Montorsi, & Schulman, 2003)

All this research would be troublesome for the AP-industry if it becomes a scientific consensus and reaches the consumer. Yet until today, perhaps the only scientific consensus is that avoiding processed meats can prevent cancer (Bouvard, Loomis, Guyton, Grosse, El Ghissassi, et al., 2015; Norat et al., 2015). Moreover, people that eat APs are usually unaware of health benefits associated with less APs (Lea, Crawford, & Worsley, 2006). Indeed a survey and focus groups showed that consumers regard meat as healthy (Verbeke, Pérez-Cueto, de Barcellos, Krystallis, & Grunert, 2010) and especially men see it as a source for vitality (Nath, 2011). Thus, despite promising research, the perceived health benefits of reducing AP consumption are relatively low.

One possible reason for this discrepancy would be that other good science contradicts the critical studies I presented. Another, that the AP-industry influences science and media to cast doubt. There

is a continuum between both those options and the scientific debate is certainly not settled yet. Yet, deeply investigating the scientific health debate would far exceed the scope of this thesis. Hence, I go the other way looking at the mechanisms by which the AP-industry might influence health perceptions. Since the AP-industry has the interest plus the financial and organizational capacity I ask sub-question 2: To what extent is the AP-industry influencing science and media related to health? In the following, I reveal possible mechanisms to influence science and media.

1.4.1 Industries do fund studies but research regarding influence is inconclusive

Food industries are funding popular science and studies published in peer-reviewed journals (Brownell & Warner, 2009). Already in the 1950s, the sugar industry funded a study that declared fat and cholesterol as the only causes for heart disease while downplaying any potential role of sugar (Kearns, Schmidt, & Glantz, 2016). This was successfully shifting the focus away from sugar to dietary fat (Kearns et al., 2016). Since then the impact of industry-studies in the field of nutrition was investigated systematically with 12 reviews drawn together in a recent meta-analysis (Chartres, Fabbri, & Bero, 2016). The meta-analyses had non-significant findings, although, 7 out of 8 studies found a positive correlation between industry-influence and favourable conclusions (Chartres et al., 2016). This might be because several reviews included only a handful of studies in one category (Bes-Rastrollo, Schulze, Ruiz-Canela, & Martinez-Gonzalez, 2013; Levine, Gussow, Hastings, & Eccher, 2003; Nkansah, Nguyen, Iraninezhad, & Bero, 2009). Furthermore, one study that could not be included in the meta-analysis, revealed significant impacts of industry funding (Vartanian, Schwartz, & Brownell, 2007). Thus, in the author's own words: "these findings suggest but do not establish that industry sponsorship of nutrition studies is associated with conclusions that favor the sponsors" (Chartres et al., 2016).

Since this review is inconclusive, further research is required. That is one reason for investigating the effects of industry-studies. Moreover, only two of the 12 studies in the review featured APs. One study investigated beverages including milk and found a significantly high effect of industry funding on articles' conclusions (Lesser, Ebbeling, Goozner, Wypij, & Ludwig, 2007). The other study, investigating milk, had non-significant results although the only three milk-sceptical studies were independent (Wilde, Morgan, Roberts, Schpok, & Wilson, 2012). Thus, evidence for AP-industry influence on science is weak and that motivates asking sub-question 2a: are industry-studies more likely to show conclusions in favour of meat?

1.4.2 Potential influence on media through industry-studies

Few people may read scientific articles but news media (just *media* in the following) can influence opinions considerably (McCombs, 2013). In the past, public opinions often varied from the scientific knowledge because of industry-influence on media reporting (Oreskes & Conway, 2010). Today, media is spreading questionable health claims as for example in the UK, the science behind 70% of health claims is neither convincing nor probable (Cooper, Lee, Goldacre, & Sanders, 2011). There are several reasons for this ranging from time pressure of journalists (Steinbrook, 2000), over exaggerated institutional press-releases (Schwartz, Woloshin, Andrews, & Stukel, 2012; Woloshin & Schwartz, 2002) to misinterpretations in the papers themselves (Boutron, Dutton, Ravaud, & Altman, 2010; Yavchitz et al., 2012). Industries may use this imperfect system by sprinkling own press releases that understate unfavourable articles (Steinbrook, 2000). Moreover, ties between journalists and industry may lead to a bias in public media (Moynihan, 2003).

However, even if newsmen rely on scientific journals they may still get industry-biased information from them. Industry-studies, get published in scientific journals while industry-unfavourable articles sometimes do not get published. This is because journals often depend on industry support (Smith, 2006). Industries buy reprints of favourable articles and occasionally order so many copies that a journal gains millions of dollars from a single industry-favourable study (Smith, 2006). Additionally, advertising is an important income source for journals and advertisers may use their bargaining power to ensure that favourable articles get published (Smith, 2006). Thus, health information can be distorted by industry-influence on science and media and the AP-industry might use such loopholes. This is the reason for asking sub-question 2d: How often do industry-studies support favourable media articles about meat and health?

1.4.3 The importance of influencing health debates

It is not only relevant how people perceives specific health issues but also which aspects they discuss. E.g. the AP-industry benefits if people question the link between APs and heart disease but also if they discuss other things than heart disease. A more industry-friendly debate are nutrients since almost all products contain some nutrients and APs are mostly rich in protein. However, strongly emphasizing nutrients may mislead people because for each nutrient there are alternative and potentially safer sources. E.g. despite containing protein processed meat should be avoided because beans, lentils, nuts and whole grains contain protein as well while at the same time reducing mortality risk (Afshin, Micha, Khatibzadeh, & Mozaffarian, 2014; Huang, Xu, Lee, Cho, & Qi, 2015; Wang et al., 2014). Moreover, after the requirements are met, additional amounts of protein and iron can be harmful (Bastide et al., 2015; Cavuoto & Fenech, 2012). Likely for such reasons, health

advocates such as the World Health Organization focus on non-communicable diseases instead of nutrients (WHO, 2008). This does not imply that nutrients are irrelevant but wrongly contextualized they can be misused. Interestingly, that is what the AP-industry has been criticised for – shifting the focus towards nutrients to mislead the public (Joshi, 2015; Nestle, 2013, p. 50 & 91). Hence, it is interesting which issues are discussed in science and media leading us to sub-question 2b: how do industry and independent studies differ regarding design and discussed issues?

And 2c: which issues are predominantly discussed in popular media related to meat and health?

1.5 Disposition: from theory to solutions

The whole approach is grounded in theories about power and doubt-making which I present in chapter 2. Hence, the methods in chapter 3 do not only reflect my research questions but also the different aspects of the theories. In the findings (chapter 4), I first answer sub-question 1 by analysing cases of industry influence on regulations. Then, a case about saturated fat preliminary answers sub-question 2. Thereby, it stimulates the quantitative methods that elaborate on industry-influence systematically: a science-review on health-related studies answers sub-question 2a & 2b and a media review evaluates influence on web pages answering question 2c and 2d. Thus, qualitative and quantitative methods are combined. This mixed method approach shall provide a comprehensive understanding of industry-influence on AP consumption which I discuss in chapter 5. Building on that, I make suggestions for different actors to reduce industry-power and AP consumption before concluding the thesis.

2 Theoretical Framework: Power and Doubt-Making

2.1 Power according to Lukes

“Power – A Radical View” (Lukes, 2005) was first published in 1974 and expanded in 2005. Lukes (2005) defines power in the following way: “A exercises power over B when A affects B in a manner contrary to B’s interests” (p. 30). Therewith he distinguishes three dimensions of power. In the first dimension, power is exercised open and directly to influence Bs behavior (Lukes, 2005, p. 20). Power there is conducted through observable decision-making (Lukes, 2005, p. 20). Examples are: building a fence to prevent strangers from trespassing or raising food prices and hence prevent some consumers from buying. The second dimension features a more covert conflict (Lukes, 2005, p. 28). There, barriers are created that obstruct the emergence of conflict by reducing options or preventing decision making (Lukes, 2005, p. 20). Examples are voting rules or the separation of potential allies – e.g. a teacher locating friends at different tables in the classroom to keep them quiet.

Most hidden is the third dimension of power, where conflict is only latent (Lukes, 2005, p. 29). In this case, A influences what B wants before any decision takes place by manipulating B’s thinking, desires and perceptions (Lukes, 2005, p. 28). In this way, a gap is created between what B wants and what she would want given her real interests (Lukes, 2005, p. 28). In some cases, even the imagination of alternatives is restricted while a habituation to the current state occurs (Lukes, 2005, p. 28). An example are ideologies that shape how people perceive the world and determine which actions they can think of. Related to this thesis, power in the 3rd dimension could shape people’s health perceptions so that they regard APs as beneficial and continue consuming.

This theory is suited to investigate industry-influence on AP consumption for several reasons. First, obvious arguments seem insufficient to explain high consumption of APs despite bad environmental impacts. Therefore, it is promising to look at hidden power which is, according to Lukes (2005), more effective than open tactics in shaping decisions (p. 2). Second, the theory can explain things that do not happen (Lukes, 2005, p. 52) such as a shift towards more plant-based foods. Furthermore, it describes how conflicts are not occurring despite existing latently (Lukes, 2005, p. 27). E.g. it can explain why people do not oppose regulations that support the AP-industry despite their harmful environmental consequences. Third, power may influence personal identities and social norms (Lukes, 2005, p. 119 & 141) which are, as stated in chapter 1, reasons for AP consumption. Lastly, disinformation is one tool for preventing alternative thoughts from arising (Lukes, 2005, p. 149) and this could be one reason for potential misconceptions about negative health consequences of APs. Thus, Lukes’ power is a promising theory to guide this research.

2.2 Doubt-making: the tobacco-style

In 2010, Naomi Oreskes and Erik M. Conway published “Merchants of Doubt – How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming”. The authors themselves do not relate their work to Lukes’ theory of power. However, I regard it as a useful concept for analysing the third dimension of power as it is exercised by the AP-industry. Therefore, I present the central argument of the book and why other authors label actions by the food industry as doubt-making.

Merchants of Doubt describes how certain industries collaborated with scientists to influence consumer beliefs and to challenge unfavourable politics (Oreskes & Conway, 2010). It describes how the tobacco industry hired scientists to conduct their own studies and to discredit other scientists (Oreskes & Conway, 2010). Simultaneously, the message that harm is not proven was repeated over and over again (Oreskes & Conway, 2010). Thereby, they influenced the scientific and public debate around the health effects of smoking (Oreskes & Conway, 2010). Furthermore, the industry delayed meaningful actions for decades. Later, other industries used the same techniques and often even the same people (Oreskes & Conway, 2010). Hence, doubt was casted questioning harm from acid rain, DDT and climate change among others (Oreskes & Conway, 2010). Sometimes, efforts were concentrated on mass media resulting in a gap between scientific knowledge and people’s beliefs (Oreskes & Conway, 2010, p. 111 & 215). For systematically casting doubt, industries choose influential scientists and created institutes such as the Marshall Institute (Oreskes & Conway, 2010, p. 147). Thus, in all cases public opinion was influenced and regulations delayed because of industry’s influence on science and media (Oreskes & Conway, 2010).

Going beyond this book, other authors compare the tobacco-techniques with the more recent attempts of the food industry (Brownell & Warner, 2009). The denial of harmful effects is similar (Brownell & Warner, 2009). Moreover, the two industries stress individual responsibility and freedom, the importance of other factors and argue that health effects depend on the person (Brownell & Warner, 2009). Instead of blaming any particular bad foods, the food industry pushes for more vague recommendations such as a balanced diet and eating a variety of foods (Nestle, 2013, p. 126). Thus, the food and tobacco industries keep things complicated and unclear to prevent meaningful actions.

As the AP-industry is a powerful actor within the food industry, we may expect them to use similar techniques and chapter 4.2 presents an example of this. Keeping the health debate alive may be crucial to sustain AP consumption since perceived complexity reduces consumer engagement

(Rutsaert et al., 2015). Hence, doubt-making could benefit the AP-industry. Therefore, both power and doubt-making guide the analyses of the cases and reviews.

3 Methodology of Cases, Science and Media Review

3.1 Exploratory cases of industry-influence

As I am not aware of any systematic investigation linking the AP-industry's power to regulatory policies, I analysed three cases to answer sub-question 1: through which mechanisms does the AP-industry influence regulations? The analyses shall reveal common industry tactics in the light of the 1st and 2nd dimension of power. Afterwards, I present the saturated fat case showing how industry influences science and media to provide some background understanding for the quantitative methods. Its analysis is framed by the 3rd dimension of power and doubt-making. All cases are exploratory (Yin, 2013) and were chosen based on availability of data, complementarity and insightfulness. Data for those cases was retrieved through internet research including scientific literature, reports, magazines and newspaper articles. The stories of those cases are not told for the first time. The last case, for example, was inspired by videos (Greger, 2015a, 2015b) from nutritionfacts.org – a donation-run website that summarizes recent findings in health-sciences. Unique here, however, is the explicit theoretical framing and the focus on my specific research questions.

3.2 Quantitative methods investigating industry-influence on science and media

A science and a media review shall answer sub-question 2: To what extent is the AP-industry influencing science and media related to health? The hypothesis is that the AP-industry influences scientific papers that are later cited in popular media affecting public health perceptions. Hence, it is split in two parts with the first one looking at influence on science. The second part then evaluates whether a potential influence on science has impacts on media as well.

In both reviews, I focus on meat instead of all APs narrowing down the research to keep it overseeable. Meat was chosen because its carbon, water and land footprint is higher than those of eggs and most dairy products (Mekonnen & Hoekstra, 2010; Nijdam, Rood, & Westhoek, 2012). Hence, high meat consumption is detrimental to sustainability and concerning industry-influence could be especially problematic. Moreover, as chapter 1.4.2 shows, it is interesting whether nutrients or deadly diseases are discussed. Therefore, I consider the content as well as the debates in both reviews.

3.3 Science review: industry-influence on papers concerning meat

3.3.1 Questions and overview

As a proxy for doubt-making, I looked at industry-influence on scientific papers that examine health impacts of meat. Such papers can have varying degrees of industry-influence with yet unknown effects (see chapter 1.4.1). Aiming to clarify the effects of industry funding, I address sub-question 2a: are industry-studies more likely to show conclusions in favour of meat? I would dismiss this if at least as many independent studies as industry-studies show conclusions in favour of meat. If, however, raising industry-influence is significantly associated with meat-favourable conclusions, this would be a sign of doubt-making influencing the science around meat. Another relevant sub-question is 2b: how do industry and independent studies differ regarding design and discussed issues?

To evaluate this, I compared independent and industry-studies regarding study design, investigated product and health issue. Thus, this review could provide decisive data understanding the extent to which the AP-industry influences content and debates in science.

The design of this investigation is similar to other studies which evaluated the influence of industry on scientific papers (Bes-Rastrollo et al., 2013; Diels, Cunha, Manaia, Sabugosa-Madeira, & Silva, 2011; Kaiser et al., 2012; Kjaergard & Als-Nielsen, 2002; Lesser et al., 2007; Levine et al., 2003; Massougbojji, Le Bodo, Fratu, & De Wals, 2014; Mugambi, Musekiwa, Lombard, Young, & Blaauw, 2013; Myers, Parrott, Cummins, & Splett, 2011; Nkansah et al., 2009; Thomas et al., 2008; Vartanian et al., 2007; Wilde et al., 2012). To check whether article's conclusions are correlated with industry-influence, the scope of industry-influence on a scientific study was categorized. Moreover, I categorized the conclusions regarding favourability for meat. Then, odds ratios were calculated between the categories of industry-influence and the paper's conclusions.

3.3.2 Search procedure

I used Scopus for my search since in another nutrition-related review Scopus revealed more relevant results than Google Scholar. Furthermore, one study declared results from Google Scholar as more relevant than those from PubMed (Nourbakhsh, Nugent, Wang, Cevik, & Nugent, 2012). Hence, Scopus might be superior to its major alternatives. Therefore, I conducted two searches with Scopus (Appendix). Groups of search terms were: several meat products; a broad range of possible health impacts; and excluded terms to avoid irrelevant results. The reason for conducting two searches was a mistake. The first search required "health" to be in the title or abstract or key words which afterwards appeared too restrictive. Hence, I conducted the second search for retrieving papers without "health" in prominent places.

The first search revealed 1297 results (08 Dec 2016) and the second had 828² results (15 Dec 2016). Of those 2125 papers 301 were retrieved for this examination while 1773 did not investigate health impacts of meat consumption and 51 were inaccessible. Then, 66 were excluded. Common reasons for not retrieving or excluding papers were a focus on animal health instead of human health or not considering consumption related health issues. Moreover, not peer reviewed papers were excluded too. Hence, 245 papers fulfilled all inclusion criteria.

3.3.3 Criteria regarding sub-question 2a

I retrieved the data for industry-influence from the acknowledgements, conflict of interest statements, financial support statements and author's affiliations. Then, internet searches revealed the type of the supporting organization. The first possible type is the AP-industry. This includes producers and manufacturers of AP, industry associations, consultancies that serve AP interests and related industries if they share the same interests (e.g. pharma companies that produce antibiotics for animals). Second, organizations that partially serve meat industry-interest including organizations that foster agricultural production (e.g. USDA, FAO). Third, industry-independent organizations that usually aim to improve public health. Those can be public entities or foundations (e.g. National Health Service, Wellcome Trust). Fourth, antagonists that have an interest opposed to the meat industry. This includes producer of meat-replacements and vegetarian associations (e.g. Alpro Foundation).

Industry Funding

Yes, only – if only AP-industry organizations are stated

Yes, partly – AP-industry and partly-industry-serving organizations founded the study

Mixed – partly-industry-serving organizations or AP-industry and independent organizations

Minor – industry contributed non-monetary things such as data, supplements or drugs. Or partly-industry-serving together with at least as many independent organizations

No, independent – study is totally funded by independent organizations

Unknown – no funding source is stated

Antagonist – organizations that promote vegetarian diets or industry with antagonistic interests

Conflicts of Interest

Yes – if at least one author received financial benefits from the AP-industry

² The second search had less results than the first one because I excluded the results from the first search by requiring "health" to be **not** in the title (Appendix 1).

Unclear – pharma industry but no detectable relationship to animal-pharmaceuticals

Not stated – no mentioning whether a conflict of interests exists

Declared none – authors declared no conflict of interests

Antagonist – at least one author is related to an antagonist

Author's Affiliations

Yes – at least one author is affiliated with the AP-industry

Mixed – at least half of the authors come from partly-industry-serving organizations. Or an industry related university departments (e.g. AP, food science, agriculture)

Unclear – authors from institutions with potential but uncertain industry-influence (e.g. pharmacy)

No – universities or institutions that don't have a stake in AP

Antagonist – at least one author works for an antagonist

Study Conclusion

I categorized the conclusions by looking at the paper's abstracts, discussions and conclusions. Hence, I looked at the abstracts, the paper's discussions and the paper's conclusions. Categories were:

Pro meat – benefits outweigh potential negative health impacts

Negative uncertain – absence of negative health impacts

Balanced – there are positive and negative aspects but none outweighs the other

Positive uncertain – absence of positive health impacts

Contra meat – downsides outweigh benefits (if any)

3.2.4 Criteria to answer sub-question 2b

With the following criteria, I could detect differences in study design and debates between independent and industry-studies. Moreover, I intended comparing studies that are similar in every regard except industry funding to check for biases.

Study type

Experimental – controlled intervention

Cross-sectional – population-based with all data from the same time

Longitudinal – population study with follow-up

Review, unsystematic – review without specifications

Systematic review – review following pre-determined procedure

Meta-analysis – study combining data from previous papers

Testing – authors evaluated concentration of certain compounds in animals or humans

Modeling – if health impacts are estimated with a (new) model

Study objects

In vitro – no animals involved

Animal – conducted e.g. on rats or insects

Human – effects on people were studied

Placebo controlled

Yes/no

Health issue

General – the study investigates several different health aspects

Cardiovascular – heart disease, atherosclerosis, cholesterol levels, blood pressure or stroke.

Cancer – all different types and stages of cancer progression

Diabetes – insulin resistance or blood sugar control

Inflammation – arthritis, acne or inflammatory markers

Cognitive – Alzheimer's, cognitive decline, dementia

Obesity – impacts on body weight or weight control

3.3.5 Categorization procedure

I downloaded the papers as well as their citations. The citations were handled with a citation software and exported to a spread-sheet saving the basic information like title, authors, year and journal. Then, I copied the authors affiliations, conflict of interest statements and funding sources into this sheet. Before analysing them, however, I made the other paper information such as paper's title invisible to reduce bias. Afterwards, I marked relevant papers and copied their pdfs into a separate folder. Excluded at this point were 101 papers that mention neither a funding source nor conflict of interest's statements. That was because those could be independent but also heavily influenced by the industry which made them unusable for answering the review's main question. The 144 papers left were then prepared for further analysis by making their acknowledgements, author affiliations, conflict of interest statements and funding sources unreadable. Furthermore, I took a break for at least 10 days to forget author related information ensuring they did not bias my judgements on the conclusions. Then, I classified the conclusions and the criteria concerning sub-

question 2b based on the blackened pdfs. Figure 2 gives an overview about the exclusion and analyses steps:

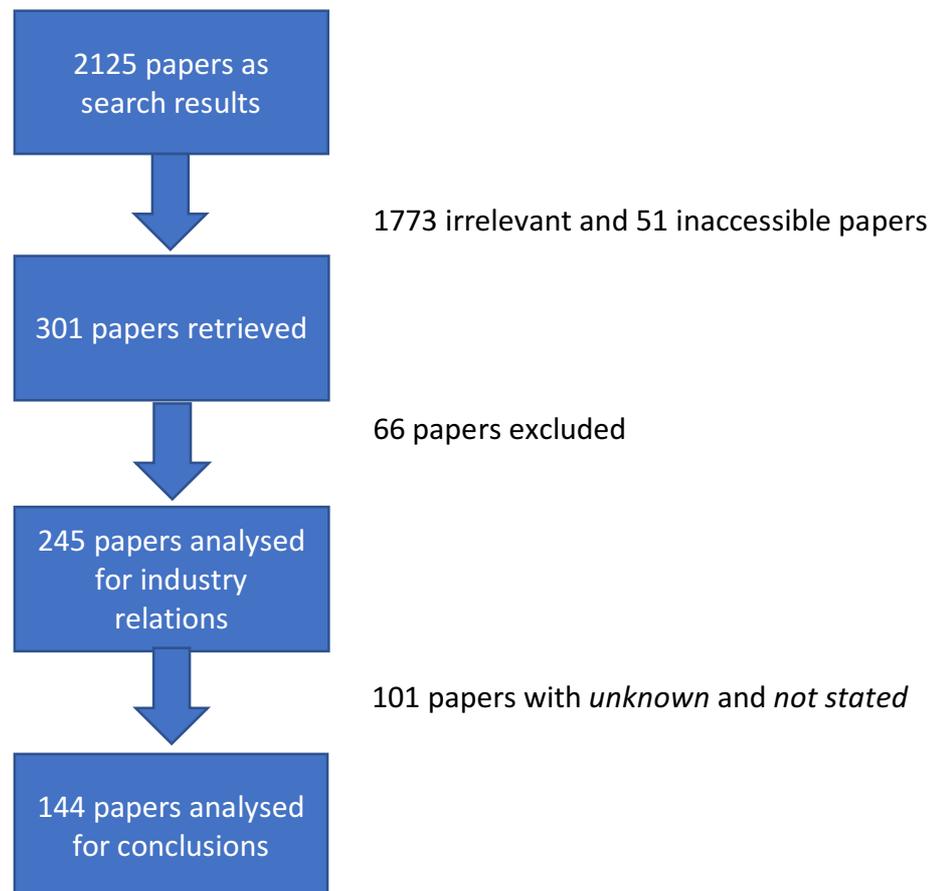


Figure 2. Flow-diagram showing how many papers were excluded at which stage.

3.3.6 Analyzing the effect of industry-influence

To check whether funding, authors affiliations and conflicts of interest are correlated with the study conclusions, odds ratios were calculated comparing high influence-papers and no influence-papers. Hence the three odds ratios are: Funding: *no independent vs. yes only/yes partly*; Authors Affiliations: *no vs. yes.*; Conflicts of Interest: *declared none vs. yes*. In all three cases the conclusions were simplified into *favourable* including *pro meat* and *negative uncertain* or *unfavourable* containing *positive uncertain* and *contra meat*. To check whether the odds ratios are statistically significant, I used the Fisher's Exact Probability test because this test is recommended for 2x2-tables (McHugh, 2009). The significance level is 0.05.

For visualizing the relationship between industry-influence and study conclusions, I translated the categories of the papers into ordinal points as stated in table 1 and 2. Thereby, the conclusions'

points are the higher the more positive a paper is regarding the health of meat. The points of the influence-categories become higher as influence raises.

Table 1. Points allocated for conclusion categories

Study Conclusion	points
Pro meat	4
Negative uncertain	3
Balanced	2
Positive uncertain	1
Contra meat	0

Table 2. Points allocated for influence categories

Industry Funding	Conflicts of Interest	Authors Affiliations	Points
Yes, only			4
Yes, partly	Yes	Yes	3
Mixed		Mixed	2
Minor or Unknown	Not stated or Uncertain	Unclear	1
No independent	Declared none	No	0
Antagonist	Antagonist	Antagonist	-1

To form aggregated influence categories, all influence-points (Table 2) were summed up for each paper (points for *Industry Funding* + points for *Conflicts of Interest* + points for *Authors Affiliations*).

The sum was then categorized according to the following criteria:

Independent/antagonist, if 0 or less points

Low industry-influence, if 1 point

Medium industry-influence, if 2 or 3 points

High industry- influence, if 4 or more points

E.g. in the *high influence*-category (industry-studies) are papers that have *yes, only* in Funding or a *yes* in Conflicts of Interest and a *mixed* in Authors Affiliations.

3.3.7 Limiting factors: single researcher, broad search and simple categorization

Compared to other articles that investigate industry-influence on science, my method has two weaknesses. First, the classification of funding was usually done by authors who had no influence on the coding of the results/conclusions and vice versa. Moreover, even single criteria were sometimes evaluated by several authors independently to ensure inter-subjectivity. This would have been difficult for me because of the limited research group-size. However, I tried to reduce my bias by evaluating the criteria at different times and blocking access to potentially distracting knowledge whenever possible. E.g. in some cases even the title already reveals the core position of the paper. Therefore, it was important to copy-paste the acknowledgement information into a spread sheet before analysing them. Second, I used only one search engine, a title search and a broad range of key

words. Hence, I did not find all relevant articles and included a variety of health issues. This would be problematic if my aim was to investigate the relationship between meat and a specific health outcome. Yet, since I am interested in the effects of industry-influence, I regard this drawback as tolerable.

Another limitation is not looking at paper's results. Analysing the results would have been desirable since they are important for dietary guidelines and the scientific debate (Chartres et al., 2016). However, this was unfeasible because of the required expertise comprising several methods and many different health issues. Concerning the criteria, independence of organizations was only questioned if substantial industry-ties were easily detectable. Hence, resolution could be improved through a deeper examination of each organization's funding sources. However, since I did not intend to determine the independence of any particular study and because much more data would have been required, the simpler method was conducted.

3.4 Media review: debates and industry-papers on web pages

Industry-studies will only impact people's health perceptions considerably if they influence popular media (McCombs, 2013). Hence, if the AP-industry casts doubt, then we should see some effects of it in media articles. First, it could be that the topics discussed are benefitting industry. Second, industry-studies might support meat-favourable media articles. Hence, there are two leading questions: 2c – which issues are predominantly discussed in popular media related to meat and health? And 2d: How often do industry-studies support favourable media articles about meat and health? The following two sections present the methods that were used to answer those questions.

3.4.1 Method to categorize meat-debates in media

To investigate the media debate about meat, I conducted a google search featuring meat and health. Google was chosen since search engines are a popular way to retrieve health information (De Choudhury, Morris, & White, 2014) and because Google is the most widely used search engine (Brossard, 2013). Thus, Google-results have the potential to influence public opinion. I used a proxy to gain non-personalized results from google.com (USA) because the US is a big market for APs. I included 100 web pages about health effects of meat consumption in the order they were listed. Concretely, I searched for *meat health* (40%), *pork health* (20%), *chicken health* (15%), *turkey health* (5%) and *beef health* (20%) on 2 February 2017. *Health* was chosen because as broad overarching term, health can be interpreted and debated in many ways. The AP-search-terms and their relative strength relate to their market share of the US-market (North American Meat Institute, n.d).

Since I was interested in all information that might influence public opinion, various web pages comprising newspapers, blogposts and association webpages were included. However, videos were excluded because they would require a different analysis as well as shop-websites and recipe websites since they are unlikely used for health information. Furthermore, book-sites and forums were excluded because they usually have no a clear position on health issues. Lastly, I excluded web pages that were unrelated to the following categories: nutrition; non-deadly health issues; deadly diseases; infections caused by pathogens in APs. E.g. if an article just claimed that meat is low in calories, it was not included. That is because it is unclear whether low calories relate to good nutrition, more vitality (because of lower body weight) or lower risk of deadly heart disease (because of less body fat).

If an article was included its statement to every mentioned health issue were checked and categorized as either *pro meat*, *contra meat* or *0* if the article did not touch the category. In the **nutrition** category, *pro meat* was for articles mentioning relevant contents of nutrients. In turn, *contra meat* was given if the relevance of existing nutrients was questioned. For the **non-deadly** category, *pro meat* got articles that assigned positive health impacts unrelated to mortality such as better fitness, more muscles or improved mood. *contra meat* was for articles that for example attested lower fertility and depressions or if they questioned positive impacts on vitality. **Deadly diseases** are e.g. cancer, heart disease, Alzheimer's and diabetes. *pro meat* were articles rejecting risk from such diseases or stating that risks were less relevant than originally thought. *contra meat* was given if articles claimed relevant linkages between meat and deadly diseases. In the **infections category** articles got *pro meat* if they claimed safety of meat or doubted risks. *contra meat* was assigned if they mentioned risks of infections through meat products. In two cases, it was unclear whether some statements were pro or contra meat. Therefore, both articles were excluded.

Additionally, I counted how many articles with meat-favourable statements compare meat to other APs. I noted if web pages compared meat with other APs in their title, subheading or if that was a reoccurring theme in the article.

3.4.2 Method to evaluate the prevalence of industry-studies in media

Using the same 100 web pages, I identified those which make pro-meat statements with support from industry-studies. Hence, if a web page pointed at positive aspects of meat, I tried to find the associated studies and evaluated whether industry-influence on them is high. The criteria for industry-influence were the same as in the meat science review – authors affiliations, conflicts of

interests and funding were checked based on the information stated in the paper. However, I did not consider industry-studies if the web page already mentions potential conflicts of interest. Web pages that did not link any sources were excluded unless I could identify the study based on the context. E.g. sometimes web pages mentioned content, author names, dates, journals or quoted from the studies which provided enough information to identify the related paper unequivocally.

3.4.3 Missing reference points as a limitation

One drawback of this investigation is the weak evidence for how media representation would look without industry-influence. When evaluating the debates, I take the results from the science review as a reference which does not even comprise the full debate in science. Therefore, the science review is not suited for a detailed comparison but rather to identify some issues that clearly leap out. The second part of the media review has a low resolution too as not all supporting science is classified. Here again a reference point is missing – how often would media report on industry-studies if it were independent from direct industry-influence? Since I was unable to answer this question, we cannot tell whether the AP-industry is actively promoting their studies from this review. Yet, for our purpose – evaluating whether industry-studies affect media – it is sufficient to count web pages with support from industry-studies.

4 Findings: Industry-Influence on Regulations, Science and Media

4.1 Cases of AP industry-influence on regulations

In this chapter, three cases reveal techniques of the AP-industry fighting regulations that would reduce sales of APs. Thereby, they show usage of the 1st and 2nd dimension of power and answer sub-question 1: through which mechanisms does the AP-industry influence regulations?

4.1.1 Influencing key decision-makers: meat Safety and the USDA

In 1993, contaminated meat killed four children and caused over 600 cases of food poisoning amplifying demands for effective inspections in the US (Consumer Federation of America, 2008). This led, finally in 1998, to a system called *Hazard Analysis and Critical Control Points* (HACCP) facilitated by the USDA (Consumer Federation of America, 2008). However, the road to HACCP was rocky. Well before the 1993 outbreak meat industry organizations had connections to high-level inspectors at the USDA (Jonson, 2002). E.g. one high inspection official was a former president of the National Cattleman's Association³ (Florida Department of Agriculture and Consumer Services, n.d.). Thus, the industry focussed on few but important political agents to prevent meaningful regulations in the early stages (Jonson, 2002). This can be classified as the 2nd dimension of power since unfavourable proposals did not even appear on the agenda.

As the new HACCP system finally was proposed, the meat industry criticised it openly – particularly one point regarded as essential by consumer groups: Salmonella-testing (Consumer Federation of America, 2008). Moreover, politicians payed by the industry demanded more studies to check the usefulness of Salmonella-tests (Jonson, 2002). Thereby, they delayed the implementation of the new rule (Jonson, 2002). Hence, HACCP came later and weaker than originally proposed but it still contained the Salmonella-testing (Consumer Federation of America, 2008). Eventually, this very test suggested the closing of slaughterhouses owned by *Supreme Beef* (Johnson, 2004). The company, however, went to court instead and won (Johnson, 2004). This use of first dimensional power undermined the force of Salmonella-tests in general – afterwards positive test results were insufficient to terminate production (Consumer Federation of America, 2008).

To repower Salmonella-testing new legislations were suggested which, however, were rejected twice in Senate (Jonson, 2002). Thereby, the second rejection was presumably caused by a concentration

³ The National Cattleman's Association later merged with other meat industry organizations to become the National Cattleman's Beef Association (Beef USA, n.d.).

of industry-power – Tyson Foods (poultry) purchased IBP (pork and beef) and thus became the biggest meat company in the world (Barboza & Sorkin, 2001). This likely increased lobbying power convincing senators from poultry producing states to oppose the new law (Jonson, 2002). To summarize this case: we saw lobbying, lawsuits and open criticism as the 1st dimension of power. Moreover, the AP-industry influenced key decision-makers – the 2nd dimension of power – and demanded more studies which is a sign of doubt-making. Thus, the AP-industry delayed and weakened regulations.

4.1.2 Big scale lobbying: the Multiple Traffic Light System in the EU

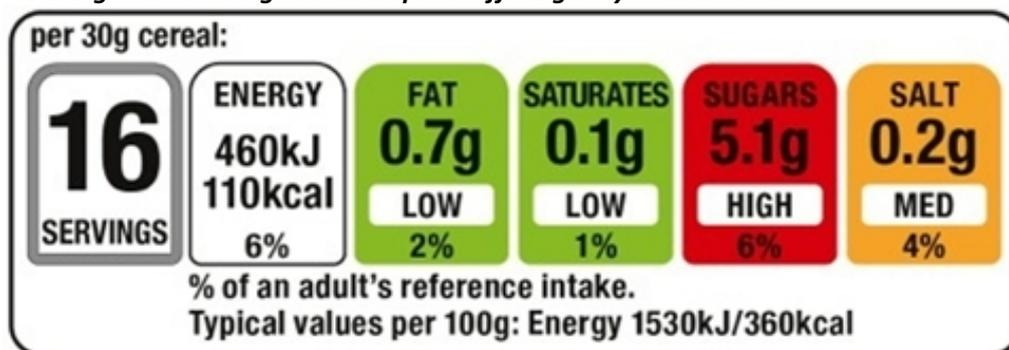


Figure 3. Example of a Multiple Traffic Light front label as it could be seen on groceries in the UK. Retrieved from <http://www.confectionerynews.com/Manufacturers/Mars-and-Nestle-adopt-UK-traffic-light-labels-Mondelez-opts-out>

In June 2010, the European Parliament stopped a proposed new front label system for groceries (EurActiv.com, 2010). Those labels with traffic light-style colour coding (Figure 3) would have enabled consumers retrieving basic nutrition information such as salt, sugar and saturated fat content within seconds. Research suggest that such labels are suited to improve consumer's decisions towards healthier purchases (Cecchini & Warin, 2016; Hawley et al., 2013). Healthier food however means inevitably also fewer calories which would harm the food industry as a whole (Brownell, 2012)⁴. In Europe, the food industry is with almost a trillion Euro turnover the biggest industry sector (Greer & Kurzer, 2013, p. 165).

Hence, lobbying efforts have been substantial: the Corporate Europe Observatory (2010) estimated that industries invested 1 billion Euro to prevent the new labelling system. Some members of the parliament criticised those efforts with one claiming that industry outnumbered public health advocates by 100 to 1 (Corporate Europe Observatory, 2010; EurActiv.com, 2010). With such open lobbying, industry used the 1st dimension of power fighting the new legislation. However, the food

⁴ Therewith this case is not only looking at the AP-industry. The AP-industry is an important part of the food industry which would have been considerably effected by the new front labels. Hence, they certainly played a role, however, here it is not distinguishable from the rest of the food industry.

industry tried influencing key decision-makers – the 2nd dimension of power – as well: only the European Commission can propose new legislations and was therefore targeted to prevent the new front-labels (Kafsack, 2015). Therewith, the food industry almost succeeded without battle as the original proposal did not contain the colour coding (Kafsack, 2015). If successful, this more hidden usage of power would have saved the industry much money. Yet, finally visible lobbying efforts – the 1st dimension of power – became necessary.

4.1.3 Winning the public debate: The Danish fat tax

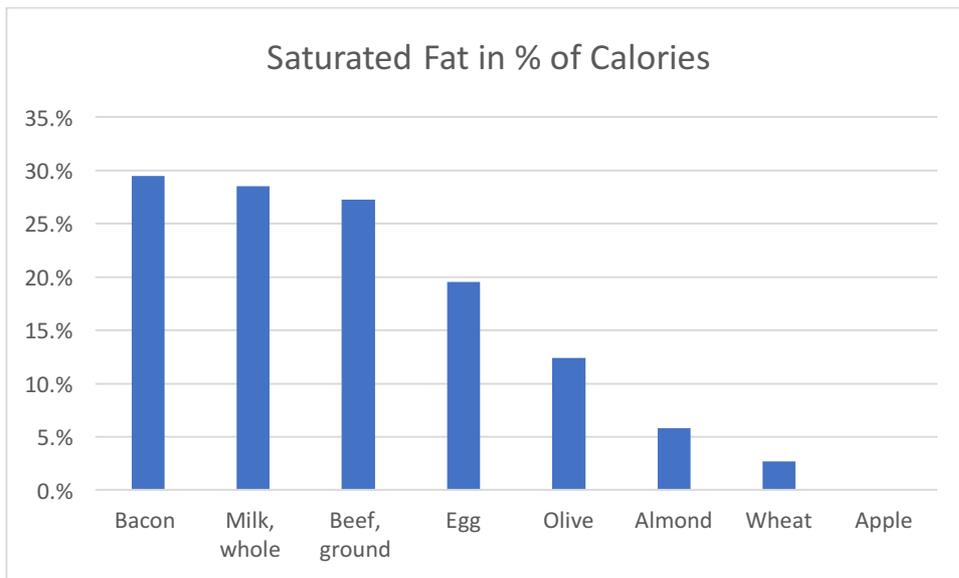


Figure 4. Share of calories from Saturated Fat on total food calories in selected animal and plant products. Source: nutritiondata.self.com

In 2011, Denmark introduced a tax to lower saturated fat (SF) consumption which, however, was abolished about one year later (Bødker, Pisinger, Toft, & Jørgensen, 2015b). SF is consistently found in almost all APs (figure 4). Evidence that SF raises cholesterol reaches back 50 years ago when first clinical trials showed a consistent linear relation between SF intake and blood cholesterol levels (D. Hegsted, McGandy, Myers, & Stare, 1965). Later, this SF-cholesterol hypothesis was confirmed by other trials which are combined in several meta-analyses (D. M. Hegsted, Ausman, Johnson, & Dallal, 1993; Howell, McNamara, Tosca, Smith, & Gaines, 1997; Mensink, Zock, Kester, & Katan, 2003). Moreover, controlled randomized trials found a direct relationship between SF and heart disease (Hooper et al., 2012). Here root recommendations against SF with the US warning people already in 1977 – despite heavy criticism by the AP-industry (Nestle, 1993). Currently, dietary guidelines around the world recommend low SF intakes (Aranceta & Pérez-Rodrigo, 2012). E.g. according to the *American Heart Organization* only every 20th calorie should come from SF and they gave this recommendation the highest level of evidence (Eckel et al., 2014). Thus, SF may be a reasonable

target for a health-promoting tax but opposition from the AP-industry should be expected because of its prevalence in APs.

Indeed the tax was heavily criticised already upfront by industry advocates for economic and equality reasons (Vallgarda, Holm, & Jensen, 2015). Moreover, the negative health implications of SF were questioned (Vallgarda et al., 2015). After its introduction, the industry led a lawsuit claiming that the tax clashes with EU law (Bødker et al., 2015b). Furthermore, special offers for butter kept consumption of SF almost stable undermining the effectiveness of the tax (Bødker, Pisinger, Toft, & Jørgensen, 2015a). Thus, the first dimension of power was at work again but eventually not alone. Interestingly, the SF tax was repealed before the health implications were clear even though health arguments were officially the main reason for its introduction (Vallgarda et al., 2015). One reason for that is that fiscal considerations were in fact more important than politicians admitted (Jørgensen, Pisinger, & Toft, 2016). Additionally, it might be that the AP-industry shifted the debate away from health consideration towards economical and equality aspects. In the end, the AP-industry joined forces with the sugar industry which feared an expansion of the tax on sugary foods (Bødker et al., 2015b). This may have sealed the tax's abolishment.

Yet, even afterwards the food tax was challenged in public by Chris Snowdon (2015) claiming that it caused job losses and economic damage. Moreover, he accused the “public health lobby”, who argued that it reduced SF intake, of twisting the facts (Snowdon, 2015). Snowdon, however, is a director of *Lifestyle Economics* and therewith part of a think-tank called *Institute of Economic Affairs* (Institute of Economic Affairs, n.d.). This institute is one of the least transparent think-tanks in the UK (Transparify, 2017) but it is known that tobacco companies supported the institute financially (Milmo, 2016). Moreover, Snowdon spoke against a sugar tax on a conference sponsored by the *British Soft Drinks Association* (Hughes, 2016). Thus, he might covertly pursue industry interest.

4.1.4 Power over regulations: summarizing the first three cases

Answering sub-question 1, the AP-industry influences regulations through open lobbying, lawsuits and by contesting their rationale in public. Thus, the 1st dimension of power is frequently used. Moreover, the industry influences key decision-makers and therewith uses the 2nd dimension of power too. An open question is whether food choices are also influenced by more hidden forces – the 3rd dimension of power. In the case of the Danish fat tax, the debate shifted from health to economics which could be a consequence of the hidden power use. Yet, evidence for that is weak leading me to investigate the 3rd dimension in the following.

4.2 AP-influence on science and media related to health

This chapter provides an overview about how the AP-industry influences science and media related to health. Therewith, I show how the 3rd dimension of power, or more concretely doubt-making techniques, are used. This shall conditionally answer sub-question 2 and motivate the quantitative methods.

We see some health-related doubt-making in chapter 4.1.1 as the meat-industry questioned scientific evidence and demanded more studies to delay safety regulations. Moreover, AP-industry organizations reach the public as stated in an industry-friendly paper: “both the Nutrition Working Group of the International Dairy Federation [...], as well as the International Meat Secretariat [...], disseminates current research findings to both the scientific community and the consumer” (Schönfeldt & Hall, 2012). This indicates that industry associations influence both the scientific and the public debate around APs.

The following case about Saturated Fat (SF) describes this in more detail. Chapter 4.1.3 shows that SF is prevalent in virtually all APs and has been linked to heart disease since the 1960s. However, from the beginning on, industry fought against dietary recommendations that would limit SF intake (Nestle, 2013). Because of such industry measures, science sometimes failed to reach the public. E.g. after 1977 US dietary guidelines regarding meat were watered down despite science becoming clearer about harm caused by SF (Nestle, 2013, p. 78). Yet, instead of such early doubt-making, the next case reveals a more recent offense of the dairy industry.

4.2.1 “Butter is back” – shaking up the saturated fat debate

One overarching dairy organization is the Global Dairy Platform which comprises many national dairy associations (Moore, 2015). Furthermore, they are supported by some of the biggest dairy producers in the world including Arla Foods (Denmark/Sweden), Deutsches Milch Kontor (Germany), Meiji (Japan) and Nestlé (Canadian Dairy Information Centre, 2015; Moore, 2015). Their mission is to increase global demand for dairy products (Global Dairy Platform, n.d.). Over themselves they say: “working behind the scenes, Global Dairy Platform pursues the best interests of its members” (Global Dairy Platform, n.d.) and that already sounds like a doubt-making strategy. Reading further, this suspicion is confirmed by their detailed targets: “[t]hreats of further regulatory restrictions such as fat taxes, limits on advertising and links with dairy to heart disease, are just a few of the many reasons [Global Dairy Plattform] is working with members to arrive at an improved image of milkfat.”(Global Dairy Platform, n.d.). They aim “at neutralising the negative image of milkfat by

regulators and medical professionals.” (Global Dairy Platform, n.d.). Lastly, they want to “promote and demonstrate dairy products’ unique nutrient content” (Global Dairy Platform, n.d.). Thus, the Global Dairy Platform works towards a positive health image and a dairy-friendly regulatory environment. Their means are communications, research and direct influence on regulations through lobbying (Global Dairy Platform, n.d.) and that indicates uses of power potentially including doubt-making.

Following this suspicion, one way of executing their agenda would be to fund studies that question the harmful effects of SF. Indeed, they have been criticised for doing exactly that ("Fat Under Fire," 2014). Focus of this critique was the following study: “Meta-analysis of prospective cohort studies evaluating the association of saturated fat with cardiovascular disease” (P. W. Siri-Tarino, Q. Sun, F. B. Hu, & R. M. Krauss, 2010a). Several things were interesting about this study: first it showed no effect of SF intake on cardiovascular disease incidents (Siri-Tarino et al., 2010a). Thus, the paper contradicted the dominant SF-heart disease-hypothesis.

Second, the authors had relations to the AP-industry and indirectly to the Global Dairy Platform. Ronald Krauss worked for consultancies, pharma companies, the National Cattleman’s Beef Association and the National Dairy Council (CHORI, n.d.; P. W. Siri-Tarino, Q. Sun, Frank B. Hu, & Ronald M. Krauss, 2010b). Of those, the National Dairy Council (USA) is especially interesting because it is a member of the Global Dairy Platform (Moore, 2015). Furthermore, it has, since 2011, founded more than 100 nutrition-related articles through 7 research centres (National Dairy Council, 2015). The National Dairy Council also supported Patty W. Siri-Tarino with a grant and honoraria (Siri-Tarino et al., 2010b). Qi Sun got support from Unilever (Siri-Tarino et al., 2010a) and Frank B. Hu participated in at least one other study completely founded by the National Dairy Council (American Heart Association, 2016). Thus, all authors in the study have benefitted from industry funding and three of them from the National Dairy Council.

Third, the study got criticised by other researchers for their observational design (Katan, Brouwer, Clarke, Geleijnse, & Mensink, 2010; Pedersen et al., 2011). In 1979, a study declared it impossible to detect the relationship between SF intake and cholesterol levels with observational studies (Jacobs, Anderson, & Blackburn, 1979). One reason is that every person has a different background level of cholesterol which causes a strong natural scattering (Jacobs et al., 1979). Moreover, disturbances in the data disguise potential relationships ("Fat Under Fire," 2014). Therefore, unlike experiments, population studies are incapable of detecting the link between SF and cholesterol levels (Jacobs et al.,

1979). This includes the relationship between SF and heart disease as well since cholesterol levels are the main mechanism by which SF increases heart disease risk (Goldstein & Brown, 2015).

Other critics were concerned about the foods which replace SF (Katan et al., 2010). Assuming western-style diets, sugar and refined carbohydrates likely replace SF and those are a risk factor for cardiovascular disease as well (Phares, 2014). Interestingly, the study got also criticised by researchers with support from margarine producers such as Unilever and Mills AB, Oslo Norway (Pedersen et al., 2011). This could be a sign that industrial antagonists joined the debate as well.⁵ However, by emphasising that most evidence is very clear regarding the link between SF and heart disease (Pedersen et al., 2011), they got support from presumably independent authors (Katan et al., 2010).

Despite concerns about conflicts of interests and heavy criticism by scientists, the study echoed in popular media. At the beginning some dietary websites and blogs used it for titles like “Saturated Fat is NOT the Cause of Heart Disease” (Briffa, 2010; Mercola, 2010). 4 years later, as a similar paper⁶ got published, the 2010-study supported the article “Eat Butter” of the Time magazine (Figure 5) (Walsh, 2014). Additionally, the industry magazine *Food in Canada* released an article titled: “New research is helping to change perception of saturated fat” (2014). Thereby, they quoted Krauss who relativized SF related health risks (“New research is helping to change perception of saturated fat,” 2014). Hence, an industry magazine used an industry-friendly scientist and an industry-study to support its positions and that without informing the reader of potential conflicts of interests. That as a side-note since it is a common doubt-making strategy (Oreskes & Conway, 2010). Critical, however, is that this study unlike many others was debated in media.

⁵ Unilever, despite being also the 12th largest global dairy producer (Canadian Dairy Information Centre, 2015) is probably an opponent of SF as evidenced by their position statement (Unilever, 2014).

⁶ This new study, although similar in design, had no detectable industry influence (Chowdhury et al., 2014).



Figure 5 showing the cover of the Time magazine promoting butter consumption. Retrieved from <https://www.dietdoctor.com/time-eat-butter-scientists-labeled-fat-enemy-wrong>

All that is concerning because if dietary information becomes contradictory, some people stop believing any health claims and lose faith in nutrition experts (Borra, Kelly, Tuttle, & Neville, 2001). If this happens people may just follow their bellies raising industry profits. The SF case reveals that such consumer irritation through doubt-making is possible. The dairy industry used their own research to influence the representation of SF in media. Additionally, the industry shifts the debate towards details – e.g. in the article they compare meat SF with cheese SF and make a distinction between small and big cholesterol-particles ("New research is helping to change perception of saturated fat," 2014). With that strategy, the dairy industry may confuse people and hence hinder meaningful changes in consumption.

This case illustrates that the dairy industry uses the 3rd dimension of power to cast doubt concerning the harmful effects of SF. However, despite being insightful, this single case is insufficient for attesting systematic doubt-making of the AP-industry. Therefore, the following review evaluates whether the AP-industry systematically influences scientific studies.

4.3 Industry-studies are more likely to show conclusions in favour of meat

The main result of the science review is that AP industry-influence can explain differences in the conclusions of investigated scientific papers. The odds ratios for authors affiliations, conflicts of interest and funding were all significantly greater than 1 (Table 4 to 6). This suggests a positive correlation between industry-influence and meat-favourable study conclusions.

Table 3. Absolute frequency and odds ratio between authors affiliations and conclusions

Influence \ Conclusion	<i>no</i>	<i>yes</i>
<i>unfavourable</i>	76	0 ⁷
<i>favourable</i>	31	6

odds ratio: 14.71
 95% CI: 1.7 to 126.58
 p-value: 0.0046

Table 4. Absolute frequency and odds ratio between conflict of interest statements and conclusions

Influence \ Conclusion	<i>declared none</i>	<i>yes</i>
<i>unfavourable</i>	47	3
<i>favourable</i>	14	7

odds ratio: 7.83
 95% CI: 1.79 to 34.35
 p-value: 0.0055

Table 5. Absolute frequency and odds ratio between funding and conclusions

Influence \ Conclusion	<i>no independent</i>	<i>yes, partly & yes, only</i>
<i>unfavourable</i>	59	3
<i>favourable</i>	19	16

odds ratio: 16.56
 95% CI: 4.35 to 63.07
 p-value: < 0.0001

To gain an impression about the effects that the aggregated industry-influence has, the following table reveals how many of the total 144 studies fall into the conclusion and aggregated influence categories:

Table 6. All 144 Studies by conclusion and influence categories

Conclusion: \ Influence:		Influence:				Sum of Conclusion
		0-indep./ant.	1 low i.	2-3 medium i.	4+ high i.	
0	Contra meat	29	37	11	3	80
1	Positive uncertain	0	2	0	2	4
2	Balanced	2	6	1	4	13
3	Negative uncertain	5	8	0	6	19
4	Pro meat	0	6	5	17	28
Sum of Influence		36	67	13	28	144

Table 6 reveals that the conclusions are more in favour of meat the higher the industry-influence is. Surprisingly, this might even be true for studies with *low* industry-influence: 6 of them were *pro meat* in contrast to none of the independent studies. More striking though is the contrast with the industry-studies (*high* category) as more than half of them are *pro meat*. Figure 6 shows the percentages of papers that are against or in favour of meat in the 4 categories of industry-influence:

⁷ To calculate the odds ratio, confidence intervals and conduct the Fisher's Exact Probability test, I assumed this value to be 1. Hence, the real odds ratio is likely higher.

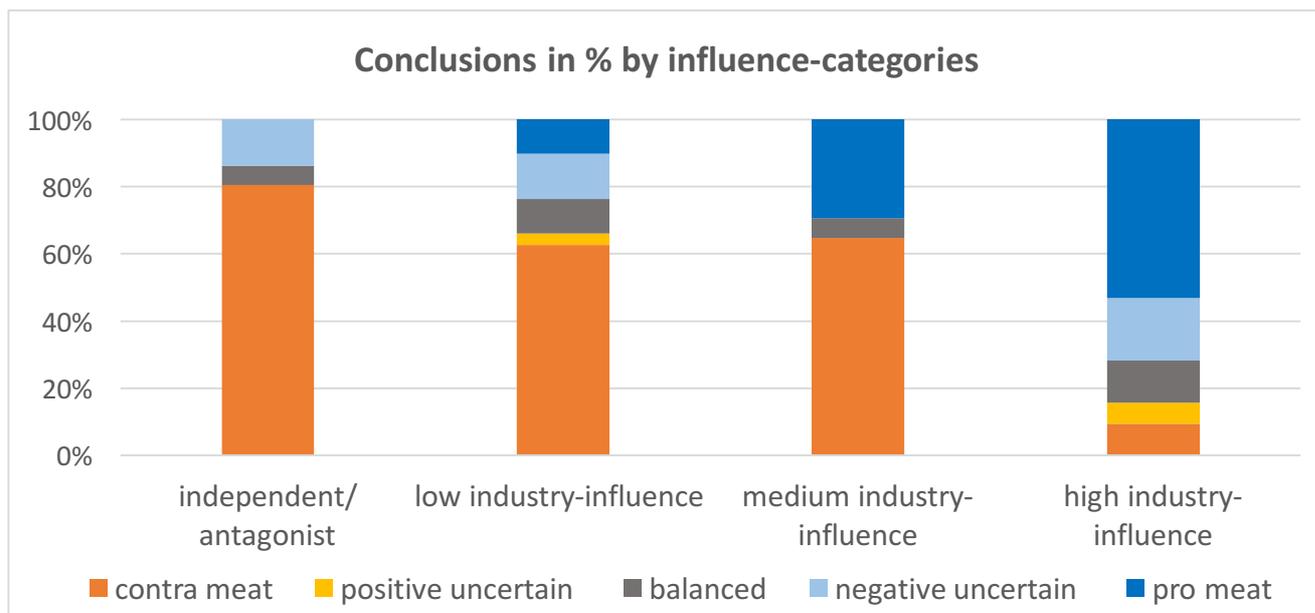


Figure 6. Chart showing the percentage of studies in each influence category with colours indicating the conclusion category.

It illustrates, that as industry-influence goes up, the likelihood of meat-favourable conclusions increases as well. Together with the odds ratios this clearly shows that AP industry-influence is associated with conclusions that are more likely in favour of meat. The next question (related to sub-question 2b) is why industry-influence is correlated to favourable conclusions. Is it that authors manipulate results, misinterpret them in the conclusions or do they rather investigate different issues?

4.3.1 Different study designs may be the main reason for diverging conclusions

Misinterpretation or spin of study results is common among randomized controlled trials (Boutron et al., 2010). However, in this case, a systematic analysis of misinterpretation is impossible since I did not categorise the paper's results. Another way to check for biases is comparing papers of similar design but with different industry-influence. Unfortunately, I could not find any pair of studies that differed in industry-influence but were yet similar enough to compare them. Hence, investigating differences in design and discussed issues was the only viable option. The following tables show those differences by categorizing the studies according to their design or issues.

Table 7. Studies by influence categories that investigate nutrition or cancer.

Influence\health issue	<i>nutrition</i>	nutrition %	<i>cancer</i>	cancer %	total
<i>independent/antagonist</i>	0	0%	13	36%	36
<i>low industry-influence</i>	2	3%	14	24%	59
<i>medium industry- influence</i>	3	23%	1	5%	19
<i>high industry-influence</i>	11	39%	0	0%	30

As indicated in the table 7, two health issues are very differently presented among independent and industry-studies (*high influence* group). More than a third of industry-studies investigate nutrients prevalent in meat products. In contrast, none of the independent studies focusses on nutrition. The absolute reverse is true for cancer which is heavily investigated by independent studies but by none of the industry-studies. In general industry-studies are more likely to focus on non-deadly health issues including cognitive abilities and muscle strength.

Table 8. Studies by influence categories with experimental or longitudinal design

Influence\study design	<i>experimental</i>	exp. %	<i>longitudinal</i>	longit. %	total
<i>independent/antagonist</i>	2	6%	11	31%	36
<i>low industry-influence</i>	2	3%	24	41%	59
<i>medium industry- influence</i>	7	37%	3	16%	19
<i>high influence</i>	13	43%	0	0%	30

Regarding study design experiments and cohort studies strike the eye (Table 8). Almost half of the industry-studies are experimental by design contrasting only two antagonistic studies. Longitudinal studies are overrepresented among low influence and independent studies and none existent among industry-studies.

Table 9. Studies by influence categories that investigate lean or processed meat.

Influence\Product	<i>lean</i>	lean %	<i>processed</i>	process. %	total
<i>independent/antagonist</i>	0	0%	6	17%	36
<i>low industry-influence</i>	0	0%	8	14%	59
<i>medium industry-influence</i>	3	16%	1	5%	19
<i>high industry-influence</i>	4	13%	0	0%	30

Moreover, industry-studies are more likely to focus on presumably healthier meat products. As shown in table 9, 17% of the independent studies investigate processed meat. In contrast, industry-

studies and those with medium influence are the only ones elaborating on lean meat. Furthermore, 8 (27%) of the industry-studies compare meat with other APs. Thus, presumably unhealthy comparatives enable positive statements about meat products.

Overall, studies with relation to the AP-industry are significantly more likely to show conclusions in favour of meat. The clearest relationship was found between industry funding and paper's conclusions, but authors affiliations and conflicts of interest likely play a role as well. Therefore, I affirmatively answer sub-question 2a: are industry-studies more likely to show conclusions in favour of meat? That confirms past research suggesting correlations between industry-studies and conclusions. Yet, despite the high divergence there is no evidence for manipulation of results or misinterpretations. Based on this data, the best explanation for the favourable conclusions is that industry-studies investigate different issues in a different way. Sub-question 2b was: how do industry and independent studies differ regarding design and discussed issues? Answering this question, industry-studies are more likely designed as an experiment and more often focus on presumably healthier meat-products. Furthermore, industry-studies rather investigate nutrients than cancer. Those differences indicate that industry motivates authors to design research in a way so that favourable findings can be expected. Like other industries (Aveyard, Yach, Gilmore, & Capewell, 2016), they influence the research agenda and this is an indication for doubt-making. The following media review reveals whether the AP-industry also influences how APs are debated in media.

4.4 Meat-debates in media: strong emphasis on nutrients

Figure 7 shows the topics discussed on web pages that write about meat and health. Hence, it answers sub-question 2c: Which issues are predominantly discussed in popular media related to meat and health? Of the four categories *nutrients* and *non-deadly* aspects were predominantly pro-meat. The infections category was almost exclusively contra-meat but the least discussed of the four. Among the most discussed *deadly diseases* contra-meat web pages had a slight edge. That deadly diseases are heavily discussed is unsurprising since they were also frequently investigated among all papers of the science review – 45% just for cancer, diabetes and heart disease combined.

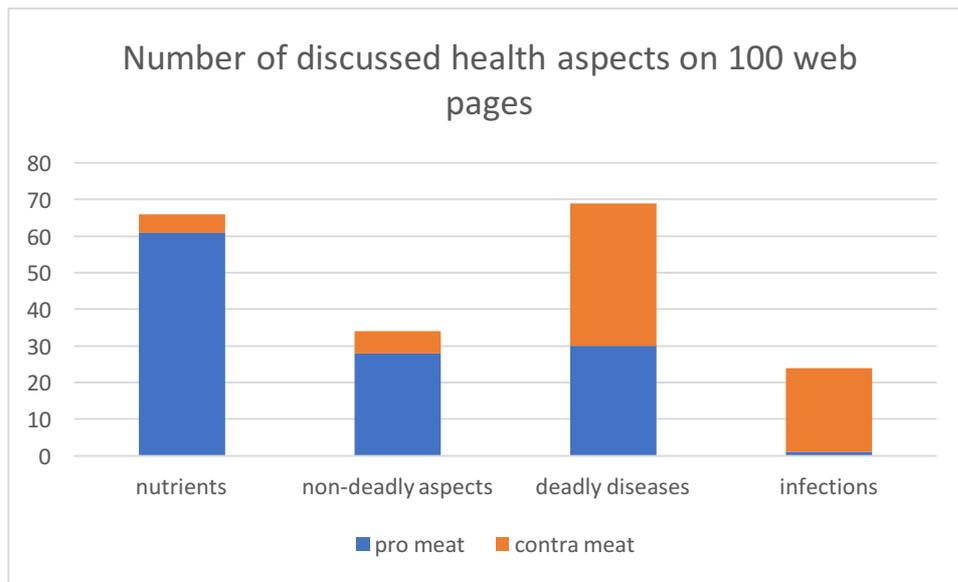


Figure 7. Chart showing the number of media articles in each category of health issues. Simultaneously, it reveals which aspects are discussed the most in this media sample.

However, striking is that about two thirds of the web pages dealt with *nutrients*. This benefits the AP-industry since mostly positive aspects of APs are emphasized in this category. Hence, one might suspect some industry-influence as in the science review of the previous chapter. There, 36% of papers with high industry-influence looked at nutrients as opposed to none of the independent studies. Thus, also considering that web pages usually touch several topics while scientific studies tend to focus on one aspect only, industry-studies come much closer to the 65% for nutrients in the media sample. Put differently: web pages tend to write about the same topic that scientific industry-papers investigate. Moreover, like industry-studies, 22 (33%) of media articles with meat-favourable statements compared meat to other APs. However, it could be that nutrient-issues and comparisons to other APs are interesting for the reader leading media to report intensively on them. Hence, those findings alone do not prove that industry-influence is the cause for meat-favourable articles in media. Therefore, it is necessary to check the direct influence of industry-studies on media in the following.

4.5 Industry-studies are prevalent in media

Of all 100 web pages, 67 made some pro-meat statements and therefrom for 27 supporting science was identified. In 20 cases the scientific papers were linked or stated below the article and in 7 cases the related studies were identified based on the context. The main result is that 22 of the 27 web pages supported their content with at least one AP industry-study. Two other cited studies that were related to pharma-companies, supplement producers and Monsanto. No web page warned the reader of potential conflicts of interest and only three were free from detectable industry-studies. Thus, we can answer sub-question 2d: How often do industry-studies support favourable media

articles about meat and health? Most web pages, with *pro meat* statements and identifiable supporting science, relied to some degree on industry-studies.

Interestingly, some of the industry-studies were cited on several web pages. The SF-study from chapter 4.2.1 was associated to 6 web pages. Another study, funded by the National Cattleman's Beef Association, was referred to five times (Roussell et al., 2012). This shows that even few industry-studies can have a considerable impact on the picture of meat in media. Moreover, it is a weak indication that industry actively promotes favourable science behind the scenes as indicated in chapter 4.2.1.⁸

However, the impact of industry-studies differs depending on the media article. One web page cited an industry-paper but also a dozen of papers without detectable industry-influence (whfoods, n.d.). In that case, the industry-study is only marginally supporting the article. In contrast, other web pages rely on one or two studies only (Beef It's What's For Dinner, n.d.; Beefnutrition.org, n.d.; Breene, 2013) – for those the indirect support from the AP-industry is essential. Thus, industry-studies are at least supportive for most investigated web pages and crucial for some of them.

Together, the review of debates and the analyses of industry-study prevalence prove that the AP-industry is influencing media through hidden industry-studies. That confirms the critical position of other authors regarding media and health information (chapter 1.4.1). Moreover, it reveals that AP-industry doubt-making reaches the public sphere. The next chapter draws together the main findings of this thesis for creating a coherent overarching picture.

⁸ Alternatively, it might be that the SF study got more media attention because it contradicted the common paradigm. However, the study from the National Cattleman's Beef Association got cited on 3 websites funded by the National Cattleman's Beef Association (Beef It's What's For Dinner, n.d.; Beefnutrition.org, n.d.; factsaboutbeef, 2015). Hence, the study got primarily promoted by own websites.

5 Discussion: The Big Picture of Industry-Power and Reflections

5.1 The role of industry-influence for AP consumption

The previous chapters show that the AP-industry is using all three dimensions of power to uphold AP consumption. The first cases concerning politics reveal that industry uses power to stop, weaken or delay regulations that would reduce consumption. The main techniques used are open lobbying, lawsuits and covert influence on key decision-makers. Thus, the first two dimensions of power are in play. Then, the saturated fat case indicated that the AP-industry also uses scientific studies to influence how healthy APs are perceived. This suspicion was checked with the science review and the media review. The science review showed that the meat industry systematically influences the science concerning meat and health. Thus, it confirms research highlighting the potential distorting role industry plays in science. Therewith, the actual impact on science is likely higher than the number of industry-studies suggests because authors often withhold information about industry relations. Results from three studies reveal that physicians fail to disclose industry funding in 48% to 69% of the cases (Norris, Holmer, Ogden, Burda, & Fu, 2012; Okike , Kocher , Wei , Mehlman , & Bhandari 2009; Rowe, 2013). Hence, the actual number of industry-studies might be much higher amplifying industry-influence on science.

The saturated fat case together with the media review stresses that industry-studies have a considerable impact on media. Most of the articles with meat-favourable statements, for which supporting studies was identifiable, referred to at least one industry-study. Arguably, articles that reference sources are of better quality. Hence, industry-influence might be even higher on the meat-favourable articles that do not reference science. Moreover, there are several high impact studies which are critical for casting doubt in popular media. Additionally, by supporting studies that focus on nutrients instead of deadly diseases, the AP-industry feeds into a debate different from independent studies. This debate about nutrition is likely less relevant for objective indicators, such as mortality, and nevertheless strongly represented in media. Certainly, the AP-industry did not create the nutrient-debate but steadily feeds into it with industry-studies. That, together with few high-impact studies to cast doubt, seem to be the main ways in which the AP-industry uses the 3rd dimension of power. Thus, answering sub-question 2, the influence of the AP-industry on science and media is multifaceted and considerable.

Since media and especially online searches are a main source of information for people, the AP-industry has an influence on health perceptions. As a side-note, I myself – vegan for 4 years – was dreaming of a *good, juicy* steak after analysing the 100 media articles. The picture of meat in the

media review is mostly positive as only 32% of the web pages were contra meat⁹. That is because of positive content and meat-favourable debates which are partly a result of industry-websites and industry-studies. Hence, people searching for health information online, are likely affected by industry-influence.

However, even when the influence on health perceptions and regulations are combined, the picture of industry-influence is still incomplete. To comprehensively answer the overall research question – **how does the AP-industry influence AP consumption?** – we should consider several other factors (figure 8): first, the AP-industry uses classic advertising to enhance consumption even further. Tyson Food Inc. alone spend \$238 million on advertisement in 2016 (United States Securities And Exchanges Commission, 2016, p. 52). Such advertisement may further enhance the positive image of APs associating them, for example, with more energy and better nutrition (Heinz & Lee, 1998; Nestle, 2013, p. 81 & 144). Second, argumentation techniques may influence the perception of meat. E.g. in the pro-meat web pages and in the industry-studies, meat was frequently compared to other less healthy alternatives. This is a way of putting meat into a positive light. Furthermore, it narrows down the debate since more radical options like a Mediterranean or a Plant-Based diet are not even considered. Third, lobbyists of the AP-industry might use industry-studies as a tool to influence politics and regulations. However, while lobbyists certainly emphasize scientific uncertainty for supporting their claims (Nestle, 2013; Vallgarda et al., 2015), the role of industry-studies for lobbying purposes is hard to evaluate.

Fourth, the power of the AP-industry is derived from AP consumption and the centralization of the industry. Centralization takes place through mergers between companies and the formation of overarching organizations that represent the industry's interests (Stuckler & Nestle, 2012). Centralisation today is already far advanced as, for example, the four biggest beef producers control three quarters of the US-market (Consumer Reports, 2015). Moreover, AP consumption is enhancing the power of the AP-industry since consumers provide money that the industry can use to increase influence. Thus, there is a reinforcing relationship between AP industry-power and AP consumption (see figure 8). Fifth, the likelihood of regulations not only depends on industry pressure but also on the public opinion about APs. In 2013, the German green party pushed the idea of a meatless day in public canteens. This caused heavy criticism, was harmful to their election results and convinced them to withdraw their proposal ("Veggie-Day ist den Grünen ab sofort 'herzlich egal'", 2014). Part of this resistance might be attributable to direct industry activities ("Veggie Day – Immer mehr Kritik an

⁹ Contra meat means that they made only negative statements. 17% made positive and negative statements and 51% were only positive. In total, there were 120 positive vs. 73 negative statements.

fleischlosem Tag ", 2013) but more may root in APs' positive image which the industry supported. Hence, like in other doubt-making cases (Oreskes & Conway, 2010), the opinions about APs can drive or undermine regulations. Altogether, answering the research question, the following Causal Loop Diagram (figure 8) gives an overview about the main mechanism by which industry-power drives AP consumption.

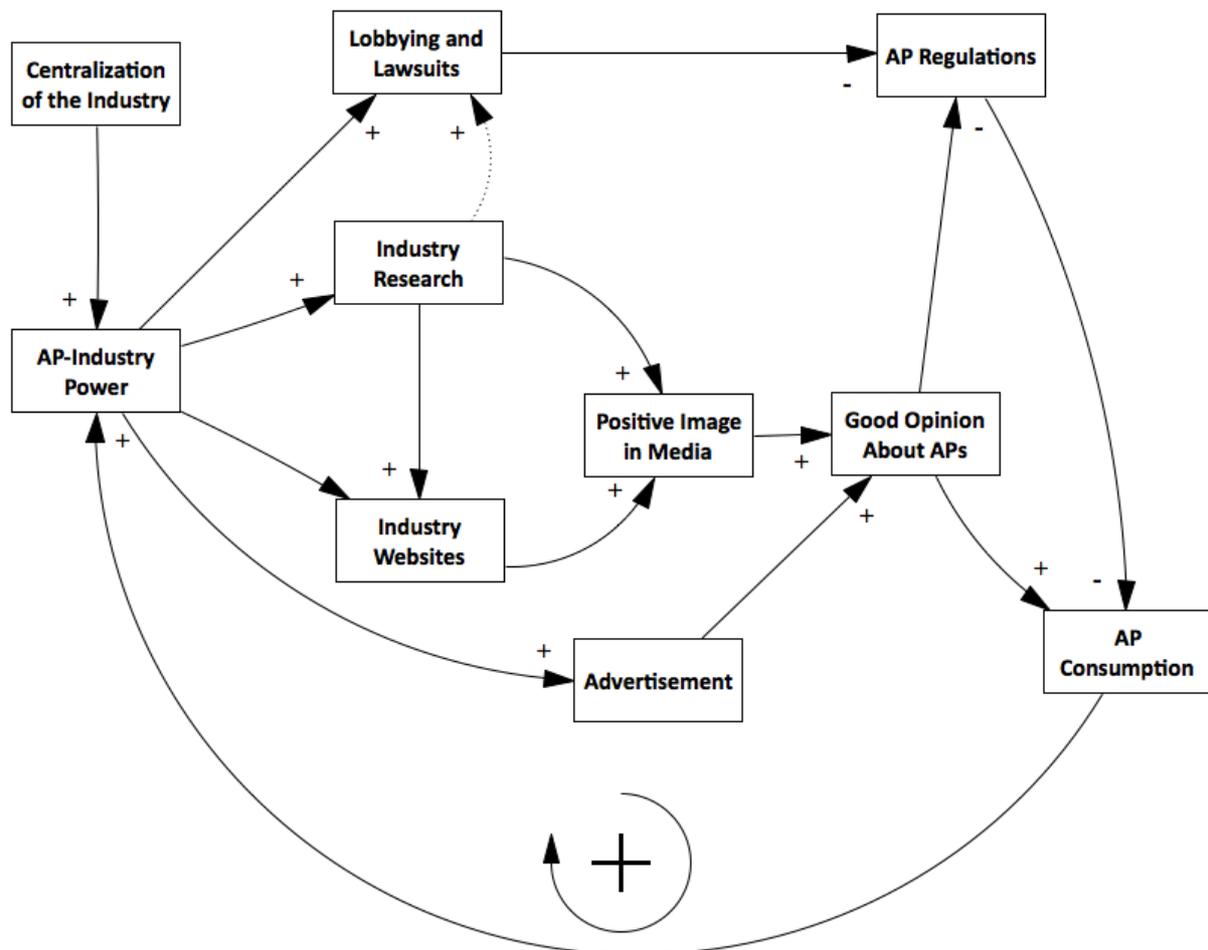


Figure 8. Causal Loop diagram of AP industry-influence on AP consumption. There is a reinforcing loop from *AP-Industry Power* over *Industry Research* and *Industry Websites* – *Positive Image in Media* – *Good Opinion About APs* on *AP Consumption*. Another goes over *Advertisement* – *Good Opinion About APs* and the third one over *Lobbying and Lawsuits* and *Good Opinion About APs* – *AP Regulations*.

5.2 The potential of the theories, mixed methods and Sustainability Science

Overall, Lukes' theory of power and the concept of doubt-making were both useful to investigate the mechanisms by which the AP-industry upholds AP consumption. They sharpened the research questions and contextualized the results. Without industry-power, there would be more regulations against APs and the health perceptions of APs would be worse. Thus, power and doubt-making can explain part of the puzzle as to why AP consumption is still high.

Sufficiently investigating all three dimensions of industry-power was only possible because of the mixed methods combining cases with systematic reviews. The most important drawback of mixed methods – high time requirements (Creswell, 2013) – was overcome by using reviews as a source for data. Hence, it was possible to systematically investigate the findings of the saturated fat case with the science and media review and combine both results. Moreover, the cases about regulations complemented the whole picture ensuring that all three dimensions of power are covered. Therefore, I regard the mixed method approach as useful for investigating industry-power.

Considering power is within the scope of Sustainability Science (Spangenberg, 2011) and the demonstrated usefulness in this thesis is an additional justification for investigating power issues. The research shows that power can provide understanding and the next chapter reveals that awareness of power also shapes the solutions available. Thus, the concept of power can stimulate Sustainability Science research. Moreover, the research indicated that addressing sustainability concerns directly might not always be the most effective strategy. Since many would reduce AP consumption for health-reasons, environmental damage of APs can be reduced by lessening industry-power and arguing for health benefits. This opens room for collaboration between sustainability and health sciences striving together for public health and environmental quality. As Sustainability Science already is a transdisciplinary field (Lang et al., 2012), this partnership would not only be fruitful but is also feasible. Furthermore, Sustainability Science could be a connector between other actors that directly strive for less AP consumption or for reducing industry-power. Those potential partners are presented in the next chapter.

6 Solutions: Reducing Industry-Power and Animal Product Consumption

Since industry-power and doubt-making are central reasons for high AP consumption, economic actors will probably not solve this problem on their own. Voluntary industry actions, e.g. reducing the use of unhealthy ingredients, have shown little effect in the past (Stuckler & Nestle, 2012). In fact, if standards are weak or implementation is not secured, voluntary actions may mislead the public and hence do more harm than good (Sharma, Teret, & Brownell, 2010). Therefore, regulations are required in most cases (Chopra & Darnton-Hill, 2004). However, one industry could play an important role: producers of AP-substitutes. As quality, taste and price of plant-based alternatives improve, more people will substitute APs (Elzerman, van Boekel, & Luning, 2013; Wild et al., 2014). Thus, competing industries will probably enhance the sustainability of global diets.

However, other food producers sometimes collaborate with the AP-industry. In the cases of the Danish fat tax and the Multiple Traffic Light System, AP and sugar-industry fought together against regulations. Moreover, even when other industries fund research that is harmful to the AP-industry, those activities can confuse the consumer. Since such research could undermine general trust in science, any industry doubt-making may be harmful in the long run. Furthermore, research by the processed food industries may shift consumption towards other unhealthy foods narrowing the debate even further. Therefore, concerning the following recommendations, I assume that reducing industry-influence in general is desirable.

Health sciences

Industry-influence on science is an important part of the industry's doubt-making strategy. Therefore, science should implement mechanisms to ensure disclosure. Moreover, journals should not publish science that is likely created for doubt-making purposes. To enable industry funding without causing conflicts of interest, fees or industry-taxes may be established that indirectly pass industry-money to researchers (Aveyard et al., 2016). Furthermore, for combating the distorted picture of science in public, scientist should communicate results to media in simple language and without exaggerations.

Politics

To reduce AP consumption, politicians should aim for subsidy-cuts and meaningful regulations while involving industries as little as possible (Jørgensen et al., 2016). This would directly reduce AP consumption and simultaneously lessen industry-power. To increase resistance against lobbying, transparency is important. Furthermore, regulations that hinder politicians from taking jobs in industry after being in parliament could reduce industry-influence. To decrease industry-power,

politicians should eliminate laws that foster their organizational capacity. E.g. in the USA, beef and dairy producers are required by law to pay a fee which is then used for organized advertising and research (Crespi & McEwen, 2006). If this fee would be abandoned, producers could decide not to support promotion activities ultimately reducing the strength of overarching organizations. Finally, funding of independent research and consumer-information campaigns may counterbalance industry-influence.

Health advocates

Health advocates should not only repeat classic health messages but also inform about industry-influence. Furthermore, they may critically elaborate on the discourses the AP-industry feeds in for shifting the debate away from deadly diseases. Yet, in some cases counter-arguments to the masculinity arguments may work as well. E.g. research indicates that erectile dysfunction is an early warning for heart disease (Esposito & Giugliano, 2011; Jackson, 2012). Hence, instead of mortality, sexual performance could be a more powerful motivator for consuming less animal fat. Lastly, health advocates should also engage politically – their inactivity was one reason for the fall of the Danish fat tax (Bødker et al., 2015b)

Media

Transparency concerning both conflict of interest of the reporters and funding of the studies is important in media as well. None of the reviewed web pages mentioned industry funding of associated scientific studies. Yet, mentioning industry-influence could help consumers to evaluate information more accurately. Moreover, media should be careful with the discourses they are using. Especially the value of nutrients should be contextualized instead of highlighting nutrients as universally good. Most importantly, scientific accuracy should not be compromised for readers' entertainment or because of time pressure.

Consumers

Consumers should eat less APs and less processed foods to foster sustainability and to reduce the power of food industries. Additionally, requesting more plant-based meals in public canteens could reduce AP consumption. Moreover, the power of big corporations can be reduced by shifting purchases to independent small-scale farmers. Finally, consumers should demand clear information such as a Multiple Traffic Light System as a front label.

Civil society

Primarily, civil society should put pressure on the other actors such as politicians, science and media to establish greater transparency, meaningful regulations and more accurate information services. Ideally, they organize to leverage their demands and counter industry lobbying.

Those recommendations, are based on the findings of this thesis that industry-power plays an important role for high levels of AP consumption especially by influencing the health debates. Generally, however, other motivators play a role for high AP consumption as well. I did not consider the potential of animal welfare arguments which are important since they frequently lead to vegetarianism (Cordts et al., 2014). Moreover, environmental arguments should not be disregarded either. Even though being a less powerful motivator than health claims, they have the advantage of being relatively uncontroversial. Therefore, depending on the audience, it might be easier to argue for regulations based on environmental concerns. On other occasions combining moral and health arguments may be most successful for reducing consumption (Zur & Klöckner, 2014). Altogether, addressing power and health debates is one among several ways for reducing AP consumption.

7 Conclusion

High levels of AP consumption are partly a result of industry-power including doubt-making. The AP-industry keeps consumption of APs up by fighting regulations with lobbying, lawsuits and influence on key decision-makers. Moreover, the AP-industry influences health-related research which affects people's health perceptions through media. This influence is hidden and disturbs the evaluation of health risks as well as the debates discussed. In addition, the AP-industry uses advertisement and specific argumentation techniques to uphold AP consumption. Thus, like other industries threatened by consumer exodus and government regulations, the AP-industry uses different forms of power including doubt-making. Hence, this thesis shows that doubt-making techniques are still in use and that they are one reason for persistent high levels of AP consumption. Since high AP consumption is detrimental to sustainability, a broad alliance of actors should facilitate a shift in diets while tacking industry-power into account.

References

- Afshin, A., Micha, R., Khatibzadeh, S., & Mozaffarian, D. (2014). Consumption of nuts and legumes and risk of incident ischemic heart disease, stroke, and diabetes: a systematic review and meta-analysis. *The American Journal of Clinical Nutrition*, *100*(1), 278-288.
- American Heart Association. (2016). Yogurt may protect women from developing high blood pressure – American Heart Association Meeting Report Abstract P169. Retrieved from <http://newsroom.heart.org/news/yogurt-may-protect-women-from-developing-high-blood-pressure>
- Aranceta, J., & Pérez-Rodrigo, C. (2012). Recommended dietary reference intakes, nutritional goals and dietary guidelines for fat and fatty acids: a systematic review. *British Journal of Nutrition*, *107*(SupplementS2), S8-S22. doi:doi:10.1017/S0007114512001444
- Aveyard, P., Yach, D., Gilmore, A. B., & Capewell, S. (2016). Should we welcome food industry funding of public health research? *BMJ*, *353*, i2161.
- Barboza, D., & Sorkin, A. R. (2001, January 02). Tyson to Acquire IBP in \$3.2 Billion Deal. *The New York Times*. Retrieved from <http://www.nytimes.com/2001/01/02/us/tyson-to-acquire-ibp-in-3.2-billion-deal.html>
- Bastide, N. M., Chenni, F., Audebert, M., Santarelli, R. L., Taché, S., Naud, N., . . . Hobbs, D. A. (2015). A central role for heme iron in colon carcinogenesis associated with red meat intake. *Cancer research*, *75*(5), 870-879.
- Beef It's What's For Dinner. (n.d.). Lean Beef 101. Retrieved from <http://www.beefitswhatsfordinner.com/leanbeef.aspx>
- Beef USA. (n.d.). National Cattlemen's Association. Retrieved from <http://www.beefusa.org/nationalcattlemensassociation.aspx>
- Beefnutrition.org. (n.d.). New Research Connects Lean Beef And Heart Health. Retrieved from <http://www.beefnutrition.org/beefandhearthealth.aspx>
- Bes-Rastrollo, M., Schulze, M. B., Ruiz-Canela, M., & Martinez-Gonzalez, M. A. (2013). Financial Conflicts of Interest and Reporting Bias Regarding the Association between Sugar-Sweetened Beverages and Weight Gain: A Systematic Review of Systematic Reviews. *PLoS Medicine*, *10*(12), e1001578. doi:10.1371/journal.pmed.1001578
- Bischoff-Ferrari, H. A., Dawson-Hughes, B., Baron, J. A., Kanis, J. A., Orav, E. J., Staehelin, H. B., . . . Willett, W. C. (2011). Milk intake and risk of hip fracture in men and women: A meta-analysis of prospective cohort studies. *Journal of Bone and Mineral Research*, *26*(4), 833-839. doi:10.1002/jbmr.279
- Bødker, M., Pisinger, C., Toft, U., & Jørgensen, T. (2015a). The Danish fat tax—Effects on consumption patterns and risk of ischaemic heart disease. *Preventive Medicine*, *77*, 200-203. doi:http://dx.doi.org/10.1016/j.ypmed.2015.03.031
- Bødker, M., Pisinger, C., Toft, U., & Jørgensen, T. (2015b). The rise and fall of the world's first fat tax. *Health Policy*, *119*(6), 737-742. doi:http://dx.doi.org/10.1016/j.healthpol.2015.03.003
- Borra, S., Kelly, L., Tuttle, M., & Neville, K. (2001). Developing Actionable Dietary Guidance Messages: Dietary Fat as a Case Study. *Journal of the American Dietetic Association*, *101*(6), 678-684. doi:http://dx.doi.org/10.1016/S0002-8223(01)00170-5

- Boutron, I., Dutton, S., Ravaud, P., & Altman, D. G. (2010). Reporting and interpretation of randomized controlled trials with statistically nonsignificant results for primary outcomes. *Jama*, *303*(20), 2058-2064.
- Bouvard, V., Loomis, D., Guyton, K. Z., Grosse, Y., El Ghissassi, F., Benbrahim-Tallaa, L., . . . Straif, K. (2015). Carcinogenicity of consumption of red and processed meat. *Lancet Oncology*, *16*(16), 1599.
- Bouvard, V., Loomis, D., Guyton, K. Z., Grosse, Y., Ghissassi, F. E., Benbrahim-Tallaa, L., . . . Straif, K. (2015). Carcinogenicity of consumption of red and processed meat. *The Lancet Oncology*, *16*(16), 1599-1600. doi:10.1016/S1470-2045(15)00444-1
- Breene, S. (2013, January 22). How to Choose the Healthiest Meats. *Greatist*. Retrieved from <http://greatist.com/health/choosing-healthiest-meats>
- Briffa, J. (2010). Two major studies conclude that saturated fat does NOT cause heart disease. Retrieved from <http://www.drbriffa.com/2010/01/15/two-major-studies-conclude-that-saturated-fat-does-not-cause-heart-disease/>
- Brossard, D. (2013). New media landscapes and the science information consumer. *Proceedings of the National Academy of Sciences*, *110*(Supplement 3), 14096-14101.
- Brownell, K. D. (2012). Thinking forward: the quicksand of appeasing the food industry. *PLoS Med*, *9*(7), e1001254.
- Brownell, K. D., & Warner, K. E. (2009). The Perils of Ignoring History: Big Tobacco Played Dirty and Millions Died. How Similar Is Big Food? *The Milbank Quarterly*, *87*(1), 259-294. doi:10.1111/j.1468-0009.2009.00555.x
- Canadian Dairy Information Centre. (2015). The Processing Sector – Top Global Dairy Companies. Retrieved from http://www.dairyinfo.gc.ca/index_e.php?s1=dff-fcil&s2=proc-trans&s3=glo20
- Cassidy, E. S., West, P. C., Gerber, J. S., & Foley, J. A. (2013). Redefining agricultural yields: from tonnes to people nourished per hectare. *Environmental Research Letters*, *8*(3), 034015.
- Cavuoto, P., & Fenech, M. F. (2012). A review of methionine dependency and the role of methionine restriction in cancer growth control and life-span extension. *Cancer Treatment Reviews*, *38*(6), 726-736. doi:http://dx.doi.org/10.1016/j.ctrv.2012.01.004
- Cecchini, M., & Warin, L. (2016). Impact of food labelling systems on food choices and eating behaviours: a systematic review and meta-analysis of randomized studies. *Obesity Reviews*, *17*(3), 201-210.
- Chartres, N., Fabbri, A., & Bero, L. A. (2016). Association of Industry Sponsorship With Outcomes of Nutrition Studies: A Systematic Review and Meta-analysis. *JAMA Internal Medicine*.
- Chemnitz, C., & Becheva, S. (2014). *Meat atlas: facts and figures about the animals we eat*. Retrieved from https://www.foeeurope.org/sites/default/files/publications/foee_hbf_meatatlas_jan_2014.pdf
- Chopra, M., & Darnton-Hill, I. (2004). Tobacco and obesity epidemics: not so different after all? *BMJ : British Medical Journal*, *328*(7455), 1558-1560.
- CHORI. (n.d.). Ronald Krauss, MD. Retrieved from http://www.chori.org/Principal_Investigators/Krauss_Ronald/krauss_activities.html
- Chowdhury, R., Warnakula, S., Kunutsor, S., Crowe, F., Ward, H. A., Johnson, L., . . . Thompson, S. G. (2014). Association of dietary, circulating, and supplement fatty

- acids with coronary risk: a systematic review and meta-analysis. *Annals of internal medicine*, 160(6), 398-406.
- Consumer Federation of America. (2008). *The Promise And Problems of HACCP – A Review of USDA's Approach to Meat And Poultry Safety*. Retrieved from http://consumerfed.org/wp-content/uploads/2010/06/150424_CFA-HACCP_report.pdf
- Consumer Reports. (2015). *Beef Report*. Retrieved from http://www.consumerreports.org/content/dam/cro/magazine-articles/2015/October/Consumer Reports Food %26 Sustainability Center Beef Report_8-15.pdf
- Cooper, B. E. J., Lee, W. E., Goldacre, B. M., & Sanders, T. A. B. (2011). The quality of the evidence for dietary advice given in UK national newspapers. *Public Understanding of Science*, 21(6), 664-673. doi:10.1177/0963662511401782
- Cordts, A., Nitzko, S., & Spiller, A. (2014). Consumer response to negative information on meat consumption in Germany. *International Food and Agribusiness Management Review*, 17, 83-106.
- Corporate Europe Observatory. (2010). *A red light for consumer information – The food industry's €1-billion campaign to block health warnings on food*. Retrieved from <https://corporateeurope.org/sites/default/files/sites/default/files/files/article/ceo-food-labelling.pdf>
- Craig, W. J. (2009). Health effects of vegan diets. *The American Journal of Clinical Nutrition*, 89(5), 1627S-1633S. doi:10.3945/ajcn.2009.26736N
- Crespi, J. M., & McEwen, R. A. (2006). The constitutionality of generic advertising checkoff programs. *Choices*. Retrieved from <http://www.choicesmagazine.org/2006-2/checkoff/2006-2-03.htm>
- Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*: Sage publications.
- Dagevos, H., & Voordouw, J. (2013). Sustainability and meat consumption: is reduction realistic? *Sustainability: Science, Practice, & Policy*, 9(2), 60-69.
- Dawson, C. J., & Hilton, J. (2011). Fertiliser availability in a resource-limited world: Production and recycling of nitrogen and phosphorus. *Food Policy*, 36, Supplement 1, S14-S22. doi:<http://dx.doi.org/10.1016/j.foodpol.2010.11.012>
- De Backer, C. J. S., & Hudders, L. (2014). From Meatless Mondays to Meatless Sundays: Motivations for Meat Reduction among Vegetarians and Semi-vegetarians Who Mildly or Significantly Reduce Their Meat Intake. *Ecology of Food and Nutrition*, 53(6), 639-657. doi:10.1080/03670244.2014.896797
- De Choudhury, M., Morris, M. R., & White, R. W. (2014). *Seeking and sharing health information online: Comparing search engines and social media*. Paper presented at the Proceedings of the 32nd annual ACM conference on Human factors in computing systems.
- Diaz, R. J., & Rosenberg, R. (2008). Spreading dead zones and consequences for marine ecosystems. *Science*, 321(5891), 926-929.
- Diels, J., Cunha, M., Manaia, C., Sabugosa-Madeira, B., & Silva, M. (2011). Association of financial or professional conflict of interest to research outcomes on health risks or nutritional assessment studies of genetically modified products. *Food Policy*, 36(2), 197-203. doi:<http://dx.doi.org/10.1016/j.foodpol.2010.11.016>

- Eckel, R. H., Jakicic, J. M., Ard, J. D., De Jesus, J. M., Miller, N. H., Hubbard, V. S., . . . Millen, B. E. (2014). 2013 AHA/ACC guideline on lifestyle management to reduce cardiovascular risk: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *Journal of the American College of Cardiology*, *63*(25_PA).
- Elzerman, J. E., van Boekel, M. A., & Luning, P. A. (2013). Exploring meat substitutes: consumer experiences and contextual factors. *British Food Journal*, *115*(5), 700-710.
- Esposito, K., & Giugliano, D. (2011). Lifestyle/Dietary Recommendations for Erectile Dysfunction and Female Sexual Dysfunction. *Urologic Clinics of North America*, *38*(3), 293-301. doi:<http://dx.doi.org/10.1016/j.ucl.2011.04.006>
- EurActiv.com. (2010, June 17). Food industry wins battle on 'traffic light' labels. *EurActiv.com*. Retrieved from <http://www.euractiv.com/section/health-consumers/news/food-industry-wins-battle-on-traffic-light-labels/>
- factsaboutbeef. (2015). Top Ten Questions & Answers about Beef in a Healthy Diet. Retrieved from <https://factsaboutbeef.com/2015/02/19/beef-healthy-diet/>
- Fat Under Fire. (2014, May 2014). *Nutrition Action Canadian* Retrieved from http://digitaledition.nutritionaction.com/article/Fat_Under_Fire/1686648/205416/article.html
- Florida Department of Agriculture and Consumer Services. (n.d.). Jo Ann Smith – Woman of the Year in Agriculture Award. Retrieved from <http://www.freshfromflorida.com/Divisions-Offices/Marketing-and-Development/Agriculture-Industry/Agricultural-Awards-and-Honors/Woman-of-the-Year-in-Agriculture-Award/Jo-Ann-Smith>
- Fontana, L., Meyer, T. E., Klein, S., & Holloszy, J. O. (2007). Long-term low-calorie low-protein vegan diet and endurance exercise are associated with low cardiometabolic risk. *Rejuvenation research*, *10*(2), 225-234.
- Forouhi, N. G., Koulman, A., Sharp, S. J., Imamura, F., Kröger, J., Schulze, M. B., . . . Wareham, N. J. (2014). Differences in the prospective association between individual plasma phospholipid saturated fatty acids and incident type 2 diabetes: the EPIC-InterAct case-cohort study. *The Lancet Diabetes & Endocrinology*, *2*(10), 810-818. doi:[http://dx.doi.org/10.1016/S2213-8587\(14\)70146-9](http://dx.doi.org/10.1016/S2213-8587(14)70146-9)
- Gallet, C. A. (2010). Meat meets meta: a quantitative review of the price elasticity of meat. *American Journal of Agricultural Economics*, *92*(1), 258-272.
- Gerber, P., Steinfeld, H., Henderson, B., Mottet, A., Opio, C., Dijkman, J., . . . Tempio, G. (2013). Tackling climate change through livestock.
- Gill, M., Smith, P., & Wilkinson, J. (2010). Mitigating climate change: the role of domestic livestock. *animal*, *4*(03), 323-333.
- Girard, M., Nikiema, J., Brzezinski, R., Buelna, G., & Heitz, M. (2014). A review of the environmental pollution originating from the piggery industry and of the available mitigation technologies: towards the simultaneous biofiltration of swine slurry and methane. *Journal of Environmental Engineering and Science*, *9*(1), 80-92.
- Global Dairy Platform. (n.d.). Growing the Demand of Milk and Dairy ... and Your Business Globally.
- Goldstein, Joseph L., & Brown, Michael S. (2015). A Century of Cholesterol and Coronaries: From Plaques to Genes to Statins. *Cell*, *161*(1), 161-172. doi:<http://dx.doi.org/10.1016/j.cell.2015.01.036>

- Greer, S. L., & Kurzer, P. (2013). *European Union public health policy: regional and global trends* (Vol. 90): Routledge.
- Greger, M. (2015a). The Saturated Fat Studies: Buttering Up the Public. Retrieved from <https://nutritionfacts.org/video/the-saturated-fat-studies-set-up-to-fail/>
- Greger, M. (2015b). The Saturated Fat Studies: Set Up to Fail. Retrieved from <https://nutritionfacts.org/video/the-saturated-fat-studies-buttering-up-the-public/>
- Hailu, A., Knutsen, S., & Fraser, G. (2006). Associations between meat consumption and the prevalence of degenerative arthritis and soft tissue disorders in the adventist health study, California USA. *The journal of nutrition, health & aging*, 10(1), 7.
- Hawley, K. L., Roberto, C. A., Bragg, M. A., Liu, P. J., Schwartz, M. B., & Brownell, K. D. (2013). The science on front-of-package food labels. *Public Health Nutrition*, 16(3), 430-439. doi:10.1017/S1368980012000754
- Hedenus, F., Wirsenius, S., & Johansson, D. J. A. (2014). The importance of reduced meat and dairy consumption for meeting stringent climate change targets. *Climatic Change*, 124(1), 79-91. doi:10.1007/s10584-014-1104-5
- Hegsted, D., McGandy, R., Myers, M., & Stare, F. (1965). Quantitative effects of dietary fat on serum cholesterol in man. *American Journal of Clinical Nutrition*, 17, 281-295.
- Hegsted, D. M., Ausman, L. M., Johnson, J. A., & Dallal, G. E. (1993). Dietary fat and serum lipids: an evaluation of the experimental data. *The American Journal of Clinical Nutrition*, 57(6), 875-883.
- Heinz, B., & Lee, R. (1998). Getting down to the meat: The symbolic construction of meat consumption. *Communication Studies*, 49(1), 86-99.
- Herrero, M., Grace, D., Njuki, J., Johnson, N., Enahoro, D., Silvestri, S., & Rufino, M. C. (2013). The roles of livestock in developing countries. *animal*, 7(s1), 3-18.
- Higgs, S. (2015). Social norms and their influence on eating behaviours. *Appetite*, 86, 38-44.
- Hooper, L., Summerbell, C. D., Thompson, R., Sills, D., Roberts, F. G., Moore, H. J., & Davey Smith, G. (2012). Reduced or modified dietary fat for preventing cardiovascular disease. *The Cochrane Library*.
- Howell, W. H., McNamara, D. J., Tosca, M. A., Smith, B. T., & Gaines, J. A. (1997). Plasma lipid and lipoprotein responses to dietary fat and cholesterol: a meta-analysis. *The American Journal of Clinical Nutrition*, 65(6), 1747-1764.
- Huang, T., Xu, M., Lee, A., Cho, S., & Qi, L. (2015). Consumption of whole grains and cereal fiber and total and cause-specific mortality: prospective analysis of 367,442 individuals. *BMC medicine*, 13(1), 59. doi:10.1186/s12916-015-0294-7
- Hughes, S. (2016, October 14). Obesity Warning: Fat Cats' Pimps At Work. *Morning Star*. Retrieved from <https://www.morningstaronline.co.uk/a-b281-Obesity-warning-fat-cats-pimps-at-work-.WJcmebGZNE7>
- Institute of Economic Affairs. (n.d.). Head of Lifestyle Economics. Retrieved from <https://iea.org.uk/christopher-snowdon/>
- Jackson, G. (2012). Erectile dysfunction and coronary disease: Evaluating the link. *Maturitas*, 72(3), 263-264. doi:http://dx.doi.org/10.1016/j.maturitas.2012.03.012
- Jacobs, D. R., Anderson, J. T., & Blackburn, H. (1979). DIET AND SERUM CHOLESTEROL DO ZERO CORRELATIONS NEGATE THE RELATIONSHIP? *American Journal of Epidemiology*, 110(1), 77-87.
- Johnson, B. B. (2004). The Supreme Beef Case: An Opportunity to Rethink Federal Food Safety Regulation. *Loyola Consumer Law Review*, 16, 159.

- Jonson, S. (2002). The Politics of Meat. *Modern Meat*. Retrieved from <http://www.pbs.org/wgbh/pages/frontline/shows/meat/politics/>
- Jørgensen, T., Pisinger, C., & Toft, U. (2016). Tax on saturated fat—does it work? : Nature Publishing Group.
- Joshi, S. (2015, December 26). How the meat industry is acting like big tobacco. *KevinMD.com*. Retrieved from <http://www.kevinmd.com/blog/2015/12/meat-industry-acting-like-big-tobacco.html>
- Kafsack, H. (2015). Kommt die Ampel ist Schluss mit Nutella. *Frankfurter Allgemeine*. Retrieved from http://www.faz.net/aktuell/feuilleton/debatten/lebensmittel-lobby-verhindert-vernuenftiges-13832395.html?printPagedArticle=true - pageIndex_2
- Kaiser, K. A., Cofield, S. S., Fontaine, K. R., Glasser, S. P., Thabane, L., Chu, R., . . . Nayyar, G. (2012). Is funding source related to study reporting quality in obesity or nutrition randomized control trials in top-tier medical journals&quest. *International Journal of Obesity*, 36(7), 977-981.
- Kaluza, J., Åkesson, A., & Wolk, A. (2014). Processed and unprocessed red meat consumption and risk of heart failure: a prospective study of men. *Circulation: Heart Failure*, CIRCHEARTFAILURE. 113.000921.
- Katan, M. B., Brouwer, I. A., Clarke, R., Geleijnse, J. M., & Mensink, R. P. (2010). Saturated fat and heart disease. *The American Journal of Clinical Nutrition*, 92(2), 459-460. doi:10.3945/ajcn.2010.29692
- Kearns, C. E., Schmidt, L. A., & Glantz, S. A. (2016). Sugar industry and coronary heart disease research: a historical analysis of internal industry documents. *JAMA Internal Medicine*, 176(11), 1680-1685.
- Kjaergard, L., & Als-Nielsen, B. (2002). Association between competing interests and authors' conclusions: epidemiological study of randomised clinical trials published in the BMJ. *BMJ*, 325(7358), 249.
- Kwok, T., Chook, P., Qiao, M., Tam, L., Poon, Y. K. P., Ahuja, A. T., . . . Woo, K. S. (2012). Vitamin B-12 supplementation improves arterial function in vegetarians with subnormal vitamin B-12 status. *The journal of nutrition, health & aging*, 16(6), 569-573. doi:10.1007/s12603-012-0036-x
- Lang, D. J., Wiek, A., Bergmann, M., Stauffacher, M., Martens, P., Moll, P., . . . Thomas, C. J. (2012). Transdisciplinary research in sustainability science: practice, principles, and challenges. *Sustainability Science*, 7(S1), 25-43. doi:10.1007/s11625-011-0149-x
- Lea, E. J., Crawford, D., & Worsley, A. (2006). Consumers' readiness to eat a plant-based diet. *European journal of clinical nutrition*, 60(3), 342-351. doi:10.1038/sj.ejcn.1602320
- Lesser, L. I., Ebbeling, C. B., Goozner, M., Wypij, D., & Ludwig, D. S. (2007). Relationship between Funding Source and Conclusion among Nutrition-Related Scientific Articles. *PLoS Med*, 4(1), e5. doi:10.1371/journal.pmed.0040005
- Levine, J., Gussow, J. D., Hastings, D., & Eccher, A. (2003). Authors' financial relationships with the food and beverage industry and their published positions on the fat substitute olestra. *American Journal of Public Health*, 93(4), 664-669.
- Li, Y., Zhou, C., Zhou, X., & Li, L. (2013). Egg consumption and risk of cardiovascular diseases and diabetes: A meta-analysis. *Atherosclerosis*, 229(2), 524-530. doi:<http://dx.doi.org/10.1016/j.atherosclerosis.2013.04.003>
- Lukes, S. (2005). Power: A Radical View (2nd). *Hampshire: Palgrave Macmillan*.

- Machovina, B., Feeley, K. J., & Ripple, W. J. (2015). Biodiversity conservation: The key is reducing meat consumption. *Science of The Total Environment*, *536*, 419-431. doi:<http://dx.doi.org/10.1016/j.scitotenv.2015.07.022>
- Martínez-González, M. A., Sánchez-Tainta, A., Corella, D., Salas-Salvadó, J., Ros, E., Arós, F., . . . Group, R. E. f. t. P. (2014). A provegetarian food pattern and reduction in total mortality in the Prevención con Dieta Mediterránea (PREDIMED) study. *The American Journal of Clinical Nutrition*, *100*(Supplement 1), 320S-328S. doi:10.3945/ajcn.113.071431
- Massougbdji, J., Le Bodo, Y., Fratu, R., & De Wals, P. (2014). Reviews examining sugar-sweetened beverages and body weight: correlates of their quality and conclusions. *The American Journal of Clinical Nutrition*, *99*(5), 1096-1104.
- McCombs, M. (2013). *Setting the agenda: The mass media and public opinion*: John Wiley & Sons.
- McHugh, M. L. (2009). The odds ratio: calculation, usage, and interpretation. *Biochimica Medica*, *19*(2), 120-126.
- Mekonnen, M., & Hoekstra, A. (2010). The green, blue and grey water footprint of farm animals and animal products.
- Mensink, R. P., Zock, P. L., Kester, A. D., & Katan, M. B. (2003). Effects of dietary fatty acids and carbohydrates on the ratio of serum total to HDL cholesterol and on serum lipids and apolipoproteins: a meta-analysis of 60 controlled trials. *The American Journal of Clinical Nutrition*, *77*(5), 1146-1155.
- Mercola. (2010). Saturated Fat is NOT the Cause of Heart Disease. Retrieved from <http://articles.mercola.com/sites/articles/archive/2010/02/25/saturated-fat-is-not-the-cause-of-heart-disease.aspx>
- Michaëlsson, K., Wolk, A., Langenskiöld, S., Basu, S., Warensjö Lemming, E., Melhus, H., & Byberg, L. (2014). Milk intake and risk of mortality and fractures in women and men: cohort studies. *BMJ*, *349*. doi:10.1136/bmj.g6015
- Milmo, C. (2016, February 12). Right-wing think-tank secured change in Government policy after £15,000 gift from mystery donor. *Independent*. Retrieved from <http://www.independent.co.uk/news/uk/politics/right-wing-think-tank-secured-change-in-government-charity-lobbying-policy-after-15000-gift-from-a6870911.html>
- Montorsi, P., Montorsi, F., & Schulman, C. C. (2003). Is Erectile Dysfunction the “Tip of the Iceberg” of a Systemic Vascular Disorder? *European Urology*, *44*(3), 352-354. doi:[http://dx.doi.org/10.1016/S0302-2838\(03\)00307-5](http://dx.doi.org/10.1016/S0302-2838(03)00307-5)
- Moore, D. (2015). The Global Dairy Plattform
- Moynihan, R. (2003). Making medical journalism healthier. *The Lancet*, *361*(9375), 2097-2098. doi:[http://dx.doi.org/10.1016/S0140-6736\(03\)13729-4](http://dx.doi.org/10.1016/S0140-6736(03)13729-4)
- Mugambi, M. N., Musekiwa, A., Lombard, M., Young, T., & Blaauw, R. (2013). Association between funding source, methodological quality and research outcomes in randomized controlled trials of synbiotics, probiotics and prebiotics added to infant formula: A Systematic Review. *BMC medical research methodology*, *13*(1), 1.
- Myers, E. F., Parrott, J. S., Cummins, D. S., & Splett, P. (2011). Funding Source and Research Report Quality in Nutrition Practice-Related Research. *PLoS ONE*, *6*(12), e28437. doi:10.1371/journal.pone.0028437
- Nath, J. (2011). Gendered fare? *Journal of Sociology*, *47*(3), 261-278. doi:10.1177/1440783310386828
- National Dairy Council. (2015). *Dairy Research for Your Business* –

- Nutrition, Product and Sustainability Research Program Overview 2011-2016*. Retrieved from Nestle, M. (1993). Food Lobbies, the Food Pyramid, and U.S. Nutrition Policy. *International Journal of Health Services*, 23(3), 483-496. doi:10.2190/32F2-2PFB-MEG7-8HPU
- Nestle, M. (2013). *Food politics: How the food industry influences nutrition and health* (Vol. 3): Univ of California Press.
- Nettleton, J. A., Diez-Roux, A., Jenny, N. S., Fitzpatrick, A. L., & Jacobs, D. R. (2008). Dietary patterns, food groups, and telomere length in the Multi-Ethnic Study of Atherosclerosis (MESA). *The American Journal of Clinical Nutrition*, 88(5), 1405-1412.
- Nettleton, J. A., Steffen, L. M., Loehr, L. R., Rosamond, W. D., & Folsom, A. R. (2008). Incident Heart Failure Is Associated with Lower Whole-Grain Intake and Greater High-Fat Dairy and Egg Intake in the Atherosclerosis Risk in Communities (ARIC) Study. *Journal of the American Dietetic Association*, 108(11), 1881-1887. doi:10.1016/j.jada.2008.08.015
- New research is helping to change perception of saturated fat. (2014, September 9). *Food in Canada*. Retrieved from <http://www.foodincanada.com/processing/new-research-helping-change-perception-saturated-fat-129374/>
- Nijdam, D., Rood, T., & Westhoek, H. (2012). The price of protein: Review of land use and carbon footprints from life cycle assessments of animal food products and their substitutes. *Food Policy*, 37(6), 760-770. doi:http://dx.doi.org/10.1016/j.foodpol.2012.08.002
- Nkansah, N., Nguyen, T., Iraninezhad, H., & Bero, L. (2009). Randomized trials assessing calcium supplementation in healthy children: relationship between industry sponsorship and study outcomes. *Public Health Nutrition*, 12(10), 1931-1937. doi:10.1017/S136898000900487X
- Norat, T., Scoccianti, C., Boutron-Ruault, M.-C., Anderson, A., Berrino, F., Cecchini, M., . . . Romieu, I. (2015). European Code against Cancer 4th Edition: Diet and cancer. *Cancer Epidemiology*, 39, Supplement 1, S56-S66. doi:http://dx.doi.org/10.1016/j.canep.2014.12.016
- Norris, S. L., Holmer, H. K., Ogden, L. A., Burda, B. U., & Fu, R. (2012). Characteristics of physicians receiving large payments from pharmaceutical companies and the accuracy of their disclosures in publications: an observational study. *BMC Medical Ethics*, 13, 24-24. doi:10.1186/1472-6939-13-24
- North American Meat Institute. (n.d). The United States Meat Industry at a Glance. Retrieved from <https://www.meatinstitute.org/index.php?ht=d/sp/i/47465/pid/47465>
- Nourbakhsh, E., Nugent, R., Wang, H., Cevik, C., & Nugent, K. (2012). Medical literature searches: a comparison of PubMed and Google Scholar. *Health Information & Libraries Journal*, 29(3), 214-222.
- Okike , K., Kocher , M. S., Wei , E. X., Mehlman , C. T., & Bhandari , M. (2009). Accuracy of Conflict-of-Interest Disclosures Reported by Physicians. *New England Journal of Medicine*, 361(15), 1466-1474. doi:doi:10.1056/NEJMsa0807160
- Oreskes, N., & Conway, E. M. (2010). *Merchants of doubt: How a handful of scientists obscured the truth on issues from tobacco smoke to global warming*: Bloomsbury Publishing USA.
- Pedersen, J. I., James, P. T., Brouwer, I. A., Clarke, R., Elmadfa, I., Katan, M. B., . . . Mensink, R. P. (2011). The importance of reducing SFA to limit CHD. *British Journal of Nutrition*, 106(07), 961-963.

- Phares, E. H. (2014, March 19). Dietary fat and heart disease study is seriously misleading. *Harvard T.H. Chan*. Retrieved from <https://www.hsph.harvard.edu/nutritionsource/2014/03/19/dietary-fat-and-heart-disease-study-is-seriously-misleading/>
- Popkin, B. M. (2011). Agricultural policies, food and public health. *EMBO Reports*, 12(1), 11-18. doi:10.1038/embor.2010.200
- Pribis, P., Pencak, R. C., & Grajales, T. (2010). Beliefs and attitudes toward vegetarian lifestyle across generations. *Nutrients*, 2(5), 523-531.
- Rizzo, N. S., Jaceldo-Siegl, K., Sabate, J., & Fraser, G. E. (2013). Nutrient profiles of vegetarian and nonvegetarian dietary patterns. *Journal of the Academy of Nutrition and Dietetics*, 113(12), 1610-1619.
- Roberts, W. C. (2010). It's the Cholesterol, Stupid! *The American Journal of Cardiology*, 106(9), 1364-1366. doi:http://dx.doi.org/10.1016/j.amjcard.2010.09.022
- Ross, L. C., Austrheim, G., Asheim, L.-J., Bjarnason, G., Feilberg, J., Fosaa, A. M., . . . Thórhallsdóttir, A. G. (2016). Sheep grazing in the North Atlantic region: A long-term perspective on environmental sustainability. *Ambio*, 45(5), 551-566. doi:10.1007/s13280-016-0771-z
- Roussell, M. A., Hill, A. M., Gaugler, T. L., West, S. G., Vanden Heuvel, J. P., Alaupovic, P., . . . Kris-Etherton, P. M. (2012). Beef in an Optimal Lean Diet study: effects on lipids, lipoproteins, and apolipoproteins. *The American Journal of Clinical Nutrition*, 95(1), 9-16. doi:10.3945/ajcn.111.016261
- Rowe, T. (2013). Less Than the Truth. *Journal of Obstetrics and Gynaecology Canada*, 35(11), 971-972.
- Rutsaert, P., Barnett, J., Gaspar, R., Marcu, A., Pieniak, Z., Seibt, B., . . . Verbeke, W. (2015). Beyond information seeking: Consumers' online deliberation about the risks and benefits of red meat. *Food Quality and Preference*, 39, 191-201.
- Säll, S., & Gren, I.-M. (2015). Effects of an environmental tax on meat and dairy consumption in Sweden. *Food Policy*, 55, 41-53. doi:http://dx.doi.org/10.1016/j.foodpol.2015.05.008
- Schönfeldt, H. C., & Hall, N. G. (2012). Consumer education on the health benefits of red meat - A multidisciplinary approach. *Food Research International*, 47(2), 152-155. doi:10.1016/j.foodres.2011.04.035
- Schwartz, L. M., Woloshin, S., Andrews, A., & Stukel, T. A. (2012). Influence of medical journal press releases on the quality of associated newspaper coverage: retrospective cohort study. *BMJ*, 344, d8164.
- Sharma, L. L., Teret, S. P., & Brownell, K. D. (2010). The food industry and self-regulation: standards to promote success and to avoid public health failures. *American Journal of Public Health*, 100(2), 240-246.
- Siri-Tarino, P. W., Sun, Q., Hu, F. B., & Krauss, R. M. (2010a). Meta-analysis of prospective cohort studies evaluating the association of saturated fat with cardiovascular disease. *American Journal of Clinical Nutrition*, 91(3), 535-546. doi:10.3945/ajcn.2009.27725
- Siri-Tarino, P. W., Sun, Q., Hu, F. B., & Krauss, R. M. (2010b). Saturated fatty acids and risk of coronary heart disease: modulation by replacement nutrients. *Current atherosclerosis reports*, 12(6), 384-390.
- Smith, R. (2006). Conflicts of interest: how money clouds objectivity. *Journal of the Royal Society of Medicine*, 99(6), 292-297.

- Snowdon, C. (2015, August 06). Denmark's fat tax was a failure — but revisionists are trying to rewrite the story. *Spectator*. Retrieved from <https://health.spectator.co.uk/revisionists-are-trying-to-turn-denmarks-failed-fat-tax-into-a-great-success-dont-be-fooled/>
- Spangenberg, J. H. (2011). Sustainability science: a review, an analysis and some empirical lessons. *Environmental Conservation*, 38(03), 275-287.
- Steinbrook, R. (2000). Medical journals and medical reporting: Mass Medical Soc.
- Stoll-Kleemann, S., & Schmidt, U. J. (2016). Reducing meat consumption in developed and transition countries to counter climate change and biodiversity loss: a review of influence factors. *Regional Environmental Change*, 1-17. doi:10.1007/s10113-016-1057-5
- Stuckler, D., & Nestle, M. (2012). Big food, food systems, and global health. *PLoS Med*, 9(6), e1001242.
- Thomas, O., Thabane, L., Douketis, J., Chu, R., Westfall, A. O., & Allison, D. B. (2008). Industry funding and the reporting quality of large long-term weight loss trials. *International journal of obesity (2005)*, 32(10), 1531-1536. doi:10.1038/ijo.2008.137
- Transparify. (2017). *Think Tanks in the UK 2017 – Transparency, Lobbying and Fake News in Brexit Britain*. Retrieved from Bristol, UK <https://davidhencke.files.wordpress.com/2017/02/c56a7-transparify-thinktanktransparencyintheuk2017.pdf>
- Trumbo, P. R., & Shimakawa, T. (2011). Tolerable upper intake levels for trans fat, saturated fat, and cholesterol. *Nutrition Reviews*, 69(5), 270-278 279p. doi:10.1111/j.1753-4887.2011.00389.x
- Unilever. (2014). *Unilever's Position on Saturated Fats Reduction*. Retrieved from https://www.unilever.com/Images/slp_unilevers-position-on-saturated-fats_tcm244-414412_en.pdf
- United States Securities And Exchanges Commission. (2016). *Tyson Foods, Inc.* . Retrieved from Wasington, D.C., USA https://www.sec.gov/Archives/edgar/data/100493/000010049308000060/form10k_092708.pdf
- Vallgarda, S., Holm, L., & Jensen, J. D. (2015). The Danish tax on saturated fat: why it did not survive. *Eur J Clin Nutr*, 69(2), 223-226. doi:10.1038/ejcn.2014.224
- Vang, A., Singh, P. N., Lee, J. W., Haddad, E. H., & Brinegar, C. H. (2008). Meats, Processed Meats, Obesity, Weight Gain and Occurrence of Diabetes among Adults: Findings from Adventist Health Studies. *Annals of Nutrition and Metabolism*, 52(2), 96-104.
- Vartanian, L. R., Schwartz, M. B., & Brownell, K. D. (2007). Effects of Soft Drink Consumption on Nutrition and Health: A Systematic Review and Meta-Analysis. *American Journal of Public Health*, 97(4), 667-675. doi:10.2105/AJPH.2005.083782
- Veggie Day – Immer mehr Kritik an fleischlosem Tag (2013, August 06). *Berliner Zeitung*. Retrieved from <http://www.berliner-zeitung.de/panorama/veggie-day-immer-mehr-kritik-an-fleischlosem-tag-3218072>
- Veggie-Day ist den Grünen ab sofort 'herzlich egal'. (2014, November 21). *Spiegel Online*. Retrieved from <http://www.spiegel.de/politik/deutschland/gruenen-parteitag-veggie-day-wird-herzlich-egal-a-1004379.html>
- Verbeke, W., Pérez-Cueto, F. J., de Barcellos, M. D., Krystallis, A., & Grunert, K. G. (2010). European citizen and consumer attitudes and preferences regarding beef and pork. *Meat Science*, 84(2), 284-292.

- Vranken, L., Avermaete, T., Petalios, D., & Mathijs, E. (2014). Curbing global meat consumption: Emerging evidence of a second nutrition transition. *Environmental Science & Policy*, *39*, 95-106.
- Walsh, B. (2014, June 23). Eat Butter. *Time*.
- Wang, X., Ouyang, Y., Liu, J., Zhu, M., Zhao, G., Bao, W., & Hu, F. B. (2014). Fruit and vegetable consumption and mortality from all causes, cardiovascular disease, and cancer: systematic review and dose-response meta-analysis of prospective cohort studies. *BMJ*, *349*, g4490.
- WBGU. (2011). *World in Transition - A Social Concept for Sustainability - Flagship Report*. Retrieved from Berlin:
- Westhoek, H., Lesschen, J. P., Rood, T., Wagner, S., De Marco, A., Murphy-Bokern, D., . . . Oenema, O. (2014). Food choices, health and environment: effects of cutting Europe's meat and dairy intake. *Global Environmental Change*, *26*, 196-205.
- whfoods. (n.d.). Turkey, pasture-raised. Retrieved from <http://www.whfoods.com/genpage.php?tname=foodspice&dbid=125>
- WHO. (2008). *WHO Global Strategy on Diet, Physical Activity and Health: A Framework to Monitor and Evaluate Implementation*. Retrieved from <http://www.who.int/dietphysicalactivity/M&E-2008-web.pdf>
- Wild, F., Czerny, M., Janssen, A. M., Kole, A. P., Zunabovic, M., & Domig, K. J. (2014). The evolution of a plant-based alternative to meat. From niche markets to widely accepted meat alternatives. *Agro Food Industry Hi-Tech*, 45-49.
- Wilde, P., Morgan, E., Roberts, J., Schpok, A., & Wilson, T. (2012). Relationship between funding sources and outcomes of obesity-related research. *Physiology & Behavior*, *107*(1), 172-175. doi:<http://dx.doi.org/10.1016/j.physbeh.2012.05.004>
- Withana, S., ten Brink, P., Franckx, L., Hirschnitz-Garbers, M., Mayeres, I., Oosterhuis, F., & Porsch, L. (2012). Study supporting the phasing out of environmentally harmful subsidies. A report by the Institute for European Environmental Policy (IEEP). *Institute for Environmental Studies–Vrije Universiteit (IVM), Ecologic Institute and Vision on Technology (VITO) for the European Commission–DG Environment. Final Report. Brussels*.
- Woloshin, S., & Schwartz, L. M. (2002). Press releases: translating research into news. *Jama*, *287*(21), 2856-2858.
- Yang, W., Lu, J., Weng, J., Jia, W., Ji, L., Xiao, J., . . . Ji, Q. (2010). Prevalence of diabetes among men and women in China. *N Engl J Med*, *362*. doi:10.1056/NEJMoa0908292
- Yavchitz, A., Boutron, I., Bafeta, A., Marroun, I., Charles, P., Mantz, J., & Ravaud, P. (2012). Misrepresentation of randomized controlled trials in press releases and news coverage: a cohort study. *PLoS Med*, *9*(9), e1001308.
- Yin, R. K. (2013). *Case study research: Design and methods*: Sage publications.
- Zhao, J., Pang, Z. C., Zhang, L., Gao, W. G., Wang, S. J., Ning, F., . . . Qiao, Q. (2011). Prevalence of metabolic syndrome in rural and urban Chinese population in Qingdao. *J Endocrinol Invest*, *34*.
- Zhu, Y. G., Ioannidis, J. P., Li, H., Jones, K. C., & Martin, F. L. (2011). Understanding and harnessing the health effects of rapid urbanization in China. *Environ Sci Technol*, *45*. doi:10.1021/es2004254
- Zur, I., & Klöckner, C. (2014). Individual motivations for limiting meat consumption. *British Food Journal*, *116*(4), 629-642.

Appendix: Search Terms

Scopus search 1 conducted on 8 December 2016:

(TITLE (**meat** OR **beef** OR **chicken** OR **pork** OR **animal**) AND TITLE (**disease** OR **health** OR **cardiovascular** OR **heart** OR **cholesterol** OR **inflammation** OR **arthritis** OR **obesity** OR **alzheimer's** OR **mental** OR **cognitive** OR **vitality** OR **nutrition** OR **nutritious** OR **fitness**) AND TITLE-ABS-KEY (**health**) AND NOT TITLE ("**animal diseases**" OR "**companion animals**" OR "**broiler chicken**" OR "**broiler chickens**" OR "**antimicrobial resistance**" OR "**animal bites**" OR "**animal model**" OR "**animal health**" OR "**animal welfare**" OR "**animal models**" OR "**human and animal**")) AND DOCTYPE (**ar** OR **re**) AND PUBYEAR > 1995

Scopus search 2 conducted on 15 December 2016:

(TITLE (**meat** OR **beef** OR **pork** OR **poultry**) AND TITLE (**disease** OR **cardiovascular** OR **heart** OR **cholesterol** OR **inflammation** OR **arthritis** OR **obesity** OR **alzheimer's** OR **mental** OR **cognitive** OR **vitality** OR **nutrition** OR **nutritious** OR **fitness**) AND NOT TITLE-ABS-KEY (**health**) AND NOT TITLE ("**animal diseases**" OR "**companion animals**" OR "**broiler chicken**" OR "**broiler chickens**" OR "**antimicrobial resistance**" OR "**animal bites**" OR "**animal model**" OR "**animal health**" OR "**animal welfare**" OR "**animal models**" OR "**human and animal**")) AND DOCTYPE (**ar** OR **re**) AND PUBYEAR > 1995