Int. Jrnl. of Soc. of Agr. & Food, 2018, Vol 25, No.1, pp. 42-58

Substitution and Food System De-Animalisation

Paper first received 5 January 2018; Accepted: 2 August 2018; Published in final form 18 January 2019

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Abstract. Situated within the context of concerns about sustainability and the over production and consumption of foods from animals the paper extends the emerging social science research field that addresses the 'de-animalisation' of the food system to explore societal debate around the substitution of foods from animals. Non-dairy milks (NDMs), made from legumes, nuts, seeds and grains provide a novel empirical case. NDMs are a substitute for dairy milk, a totemic food within national diets across the global North but one that to date has received limited attention within investigation of food system de-animalisation. A frame analysis is employed to explore how different food system actors make sense of the relationship between NDMs, dairy milk and food system sustainability. Identification of frames is undertaken through a qualitative methodology in which thematic analysis is conducted of exploratory primary data (seven semi-structured interviews) and secondary textual data from a wide range of sources. Two 'pro NDM' and one 'pro dairy' frames are identified, each associated with distinct groups of food system actors and emphasising different dimensions of sustainability. The paper concludes by reflecting on what the analysis reveals about substitution as a strategy within food system de-animalisation and the politics and governance of this process, and offers suggestions for social science research into these issues.

Food system sustainability and the challenge of 'de-animalisation'

A particularly controversial dimension of debates surrounding global food system sustainability is the over production and consumption of food derived from animals. A landmark report is 'Livestock's long shadow', published in 2006 by the Food and Agriculture Organisation of the United Nations which identified the greenhouse gas emissions from livestock production as a major contributor to climate change (Steinfeld et al. 2006). Alongside a range of other environmental and animal welfare impacts of intensive livestock farming (Miele 2011) excessive levels of consumption of foods from animals have been linked to human health problems leading to some medical professionals recommending a reduction by more than half of average meat consumption in countries in the developed world to reduce diet-related diseases (McMichael et al. 2007; Fehrenback et al. 2015). An increasingly diverse group of actors including from science, civil society and the private sector argue that a transition to a more sustainable food system will need to involve a degree of 'de-animalisation' (after Fourat and Lepiller 2017), a process that concomitantly will place greater emphasis on plant based eating. This presents considerable food system governance challenges (Vinnari and Vinnari 2014).

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ISSN: 0798-1759 This Journal is blind refereed.

In the emerging field of social science research that addresses food system de-animalisation as 'de-meatification' (e.g. Dagevos and Voordouw 2015; Weis 2013; Emel and Neo 2015; Morris 2018; Mylan 2018) attempts have been made to theorise transitions to reducing meat production and consumption (de-Bakker and Dagevos 2012; Sage 2014; Vinnari and Vinnari 2014). Associated with these transitions are various strategies, amongst which is the *substitution* of meat with meat analogues i.e. food products that are manufactured and/or marketed to partially or entirely replace meat in meals.. Substitution between different types of food products has been identified as particularly important within the de-meatification pathway that involves mobilising the most committed meat eater to change their consumption patterns, albeit subtly and slowly[1] (Sage 2014). In doing so it is envisaged that this pathway has the potential to realise food system 'sustainability by stealth' (de-Bakker and Dagevos, 2012) as the consumption of meat substitutes implies that changes in eating practices do not need to be particularly radical to make a positive contribution to sustainability[2]. Although Sage (2014) argues that this pathway is more appropriately conceptualised as one of 'Reluctance' he agrees that it includes an important role for meat substitution. 'Moderate involvement' in meat reduction is the second route of transition identified by de-Bakker and Dagevos (2011) and one that moves beyond "mere substitution" (Sage 2014: 194), while Sage prefers 'Flexitarianism' as the identifier of this second pathway. A final pathway of 'Cultural change' (de-Bakker and Dagevos 2012) or 'Pioneers' (Sage 2014) is peopled predominantly by vegetarians and vegans, involving the most marked transgressions of culturally prescribed boundaries around foods from animals and, in the terms employed by de-Bakker and Dagevos (2012), a stronger form of sustainable consumption than the first two pathways.

This paper takes these debates as its starting point, focusing attention on substitution as a particular dimension of food system de-animalisation[3]. In the analysis of pathways to de-meatification outlined above, meat substitutes are largely 'blackboxed' and the process of substitution taken as a given, with its success or failure attributed mostly to consumers and / or presented as a "passive alteration"[4] of the diet (de-Bakker and Dagevos 2012: 891). Similarly, some studies that are concerned more directly with substitutes for food from animals have focused on consumer acceptability and use (e.g. Elzerman et al. 2013; Jallinoja et al. 2016; Vainio et al. 2016) while Twine (2017) provides insights into the multiple ways substitutes feature in the practices of veganism. For example, he draws attention to their vital role as material "aids to transition … [allowing]… a high degree of continuity … between omnivorous, vegetarian and vegan diets" (Twine op cit: 172), while also observing considerable ambivalence amongst vegans

[1] The implication being that substitutions happen in the context of *some* meals but not in all and not necessarily *all* of the time.

[2] There are parallels here with Hill and McRae's (1995) conceptualisation of the transition from conventional to sustainable agriculture which identifies 3 stages - 'efficiency' 'substitution' and 'redesign' – in the movement from 'shallow' to 'deep' sustainability. Specifically, "in the substitution phase, resource-dependent and environmentally disruptive products and procedures are replaced by those that are more environmentally benign" (p.82).

[3] The focus on substitution contains and makes manageable the analysis herein. It is recognised that other strategies to de-meatification and de-animalisation can be identified and deserve examination. However, this is the task of later research.

[4] Although it is noted that Sage's (2012) analysis of pathways to de-meatification seeks to go beyond a consideration of eating choices and the role of consumers in effecting food system change. Also, specifically with respect to meat substitutes, his work provides a short history of the development of the meat analogue 'Quorn' including a brief consideration of some of its controversial dimensions. Likewise, although de-Bakker and Dagevos (2012: 891) assert that meat analogues passively alter diets they simultaneously recognise that these substitutes "deserve ethical attention and approval as interesting ways of sustainable food consumption", a recommendation that is pursued by this paper.

towards substitutes e.g. due to their often highly processed and conformist character. Twine's analysis speaks to the visceral engagement with the 'non-stuff' of food discussed by Sexton (2016), specifically Beyond Meat's alternative (plant based) protein products which this manufacturer argues are not intended as substitutes for meat but as a different, 'better' meat that avoids many of the claimed for problems of meat from animals.

As a contribution to this emerging field of scholarship on the substitution of foods from animals this paper aims to explore wider, societal level debate surrounding this process. As such it adopts a deliberately discursive perspective which complements the practice-based and material emphasis of Twine (2018) and Sexton (2016). The focus on the wider debates surrounding substitution is justified because this process involves a direct challenge to the meat and dairy industry as well as other food system actors who continue to align themselves with cultural norms that position food from animals as central to diets (van der Zee 2018). In short, the substitution of food from animals is likely to generate debate, with implications for how sustainability and health claims are presented and acted upon, and how market share is acquired for various companies and products. However, this has yet to be thoroughly investigated. The question that is addressed by the paper is as follows: how do different food system actors position themselves around the substitution of food from animals and what are the implications for moves towards food system de-animalisation, in particular the politics and governance of this process? In order to operationalise this central research question, the following further questions guide analysis: who are the interested actors associated with the production and consumption of substitutes, why are they interested and where are they located? What are the arguments being made about substitutes, what evidence is being mobilised and to what extent do sustainability concerns feature within these arguments? What are the areas of contestation and consensus surrounding substitution?

The paper approaches its task through a novel empirical focus on substitutes for dairy milk. The latter is an important category of food from animals and much like meat has enjoyed a totemic status within the diets of most nations across the global North (e.g. Dupuis 2002; Nimmo 2010; Wiley 2011). Nevertheless, within the literature on de-animalisation, dairy foods and milk in particular have attracted much less direct research attention than meat and de-meatification[5] (although see Mouat and Prince 2018). Specifically, the paper examines plant-based or non-dairy milks, hereafter referred to as 'NDMs', milk-like liquids[6] produced from soy, nuts, seeds and grains. The range of NDMs has expanded considerably in recent years, with the global market value predicted to increase to $19.5b by 2020 (Markets and Markets 2015). In the UK NDMs are sold in all mainstream supermarket chains usually located alongside their dairy equivalents in both chilled and 'long-life' formats. NDMs are now advertised on the television and widely available

[5] However, dairy foods have begun to be the subject of critique within popular culture e.g. the 2014 film 'Cowspiracy', produced by Filmmakers Kip Andersen and Keegan Kuhn, addresses the effects of cattle on the environment, and the spoof documentary 'Carnage' (2017), directed by comedian Simon Amstell, depicts a vegan future in which citizens seek psychological support to help them address the guilt of having once been consumers of cheese.

[6] It is acknowledged that the labelling of these dairy milk substitutes as 'milk' is not unproblematic. In both Europe and the US there are ongoing regulatory battles around whether or not such products can be referred to as milk. For example in June 2017 the European Court of Justice reinforced the legal difference between dairy milk and plant-based alternatives, and reserved use of the milk label for the former. More recently the French government ruled that producers of meat and dairy substitutes are not permitted to use words such as cheese, milk, steak, bacon, sausage to describe their products because they are not derived from animals (The Guardian, 2018). Meanwhile, Twine (2017: 173) reports that Unilever (owners of Hellman's mayonnaise) "attempted to sue Hampton Creek, makers of [Just Mayo] a vegan mayonnaise…on the grounds that a product must contain egg in order to be called mayonnaise".

in both chain and independent coffee shops, for use in hot drinks. Soy milk, it is reported, "is so ubiquitous it enjoys its own genre of jokes – 'soy-latte liberalism' being the latest derisory term for comfortably-off lefties" (Quinn, 2014). NDMs, therefore, are of interest as they have the potential to contribute to a reduction in the consumption of dairy foods. However, as the analysis herein will demonstrate, the case for NDMs is made in variable ways and is not without its detractors. In turn this raises questions about substitution more broadly as a strategy within food system de-animalisation. In short, NDMs provide an interesting and useful case for exploring the substitution of food from animals because: they are rising in market share, a trend which is predicted to continue by market analysts; their production and use has significant sustainability implications; they are understudied relative to meat alternatives.

The next section of the paper situates the analysis in historical context by providing a brief account of the development of NDMs and the NDM market within the UK and more widely within Europe and North America. The paper then specifies a methodological approach to exploring the substitution of dairy milk by NDMs and the connections made within these to food system sustainability. In doing so it explains how 'frame analysis' was conducted using a combination of primary and secondary data sources. The following section presents two 'pro NDM' and one 'pro dairy' frames, each associated with distinct groups of food system actors and emphasising different dimensions of sustainability and adopting different positions on substitution. The paper concludes by reflecting on what the analysis reveals about substitution as a strategy within food system de-animalisation and the politics and governance of this process. Specifically, conflicts between the frames signal a new politics of dairy milk associated with its consumption rather than production, entailing a challenge to dairy milk's dietary dominance, including a questioning of why this food is consumed in the first place and whether, or the degree to which, it should continue to be consumed. In terms of governance, explicit reference to institutional action is not a consistent feature of the frames identified. However, the analysis indicates that different food governance domains are being unevenly implicated in the governing of plant-based eating, of which the substitution of dairy milk by NDMs is just one element, with questions arising about the need for a more pronounced role for public policy. The final section of the paper also offers suggestions for social scientific research into these issues.

Non-dairy milks: from the margins to the mainstream

Although soya milk has a long history in China, in the west there has not been the same interest with dairy milk favoured instead (Curry 2013; Shurtleff and Aoyagi, 2013). Historical scholarship has revealed the work involved in constructing dairy milk as an iconic healthy and 'natural' food that is vital to good nutrition (Dupuis 2002; Nimmo 2010; Wiley 2011). By the 20th century, there was a small but notable shift of NDM manufacture and consumption from Asia to other countries particularly the US in which there had been some domestic production of different types of NDM from the late 19th century. Associated with this were NDM pioneers, including Arthur Ling who was the Chair of The Plant Milk Society formed in the mid-1950s, an off shoot of the UK's Vegan Society dedicated to the production of a palatable alternative to dairy milk. In Ling's reflections on the early days of the Plant Milk Society he describes how his company faced a number of challenges: "Because initially our sales were on the small side, we faced the problem of having to pay expensively for small quantities of raw materials and we also had to work very much with improvised machinery" (Mather, 1986, no page). Research and development were required to rid soya milk of its bitter beany taste and green colour but also "the major problem was to demonstrate

the need for an alternative to dairy milk. We had therefore a double act to perform: of educating as well as selling" (Mather, 1986, no page).

Subsequently, a number of technical breakthroughs have improved palatability, and the use of tetrapak packaging has contributed to the long term storage and transportation of NDMs without refrigeration. Such developments are a partial but insufficient explanation for NDM market growth, including the emergence of plant milks made from plants other than soya, in recent years. Market research has documented notable growth in 'dairy alternatives' particularly since 2010. Global sales of NDM reached $16bn in 2016 (Daneshkhu, 2017) and global market value is predicted to increase at an annual rate of about 15.5% from 2015 to $19.5b by 2020 (Markets and Markets 2015). Globally, the NDM market is dominated by the Asia-Pacific region, followed by North America with the former projected to grow at the most rapid rate (Market and Markets 2015). Market growth in dairy alternatives is evident in Europe but is less strong than in North America. Research by Mintel (2016, also Brockman 2015) suggests that in Europe on average 24% of the population of six high consuming countries use NDMs compared with almost 50% in the US, with Germany, Spain and Italy the countries with the highest consumption. Differences in lactose intolerance and milk allergy explains some of the observed geographical differences. For example, it is claimed that 15% of the German population are lactose intolerant compared to 5-15% in the UK (ProCon 2010). NDM market share (in terms of retail value sales) reached between 2 and 11% of dairy sales in 2015, including: 11% in the United States, 9% in Belgium, 8% in Spain and France, 7% in the Netherlands, 5% in the UK, 4% in Ireland, and 2% in Finland (data from Euromonitor). Market growth rates are also high, the UK for example experiencing a 40% increase in three years, from 2011 (Quinn 2014), increasing consumption to 92 million liters in 2013 (Urwin 2015).

The growing share of UK supermarket shelf space occupied by NDMs has been accompanied by further diversification in terms of primary ingredient and product variety evident in plain, (un)sweetened, or flavoured NDMs (Market and Markets 2015). However, in 2014 plain, unsweetened NDMs, which most closely resemble dairy milk, still constituted the largest NDM market (Market and Markets 2015). The mainstreaming of NDMs can also be observed in the use of soya milk within the typical shopping basket used to calculate the rate of inflation in the UK economy (Morley 2017). That NDM producers have been acquired by food companies with a major interest in dairy foods is another indication of how NDMs have become more established within the food system e.g. European NDM companies Alpro and Provamel and US based NDM producer Whitewave have been purchased recently by the multinational consumer goods company Danone (Massoudi et al. 2016). Having provided this context, the discussion now turns to how NDMs are variously framed in relation to dairy milk and food system sustainability by interested food system actors, firstly describing the means by which these different framings were identified.

Exploring the substitution of dairy milk by NDMs through a frame analysis: concept and method

The concept of framing and frame analysis is widely deployed across social science disciplines including those contributing to the field of agri-food studies (e.g. Mooney and Hunt 2009; Kirwan and Maye 2013; Meyers and Abrams 2010; Riverra-Ferre 2012; Morris et al. 2015, 2016). Although frame analysis has a number of variants one approach is to define a frame as a shared construct that is strategically developed and deployed by a group to persuade others of their understanding of an issue and the particular actions that are required to address it. Different social groups are likely to adopt different ways of framing reality. In the case examined here it is

anticipated that different stakeholders will deliberately adopt different positions on the production and consumption of food from animals, milk in particular, and their substitution. Frame analysis seeks to reveal the "particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation" (Entman 1993: 52) that comprise the key dimensions of any frame. The identification of these dimensions within the analysis of empirical materials is useful for distinguishing the main points of contention in the case of dairy milk substitution through NDM.

A further important feature of frame analysis is that frames are likely to indicate how a group understands the problem at stake should be governed. In other words, in defining a problem in a particular way and recommending particular solutions to that problem, actors associated with a frame will, either implicitly or explicitly, signal which governance arrangements they believe are needed or are likely to be most appropriate and in doing so may emphasise state and / or market and / or civil society institutions (Renting et al 2012). As Jenkin et al. (2011: 1029) further explain, "the basic premise of any investigation into framing is … that framing has the potential to influence policy through its effect on public, political or policy discourse" and so by analysing how particular groups frame an issue this contributes to making transparent "the interests behind the frames and therefore who benefits and loses from various policy options". In short, frame analysis provides a window into the politics of a particular matter of concern. Identification of 'dominant' and 'counter' frames (e.g. Benford and Snow 2000) within a debate can help to elucidate the relative importance of particular ways of framing amongst interested actors.

In order to identify the different ways in which the substitution of dairy milk by NDMs are being framed empirical material was produced through several rounds of research. The first round involved analysis of 109 secondary documents, which took place during June and July 2016. Secondary sources were identified using a number of predefined search terms in Google including 'non-dairy milk', 'plant milk', 'plant drink', continuing the search until all relevant documents and organisations were judged to have been reached. While recognising that "any search engine provides access to only a portion of the Web" (Bryman, 2012: 655) the accuracy of Google as a search engine has been established by earlier studies of this matter (Thelwall, 2008; Weaver and Bimber, 2008). The following kinds of secondary sources were used to gather information including market research, commercial, NGO and policy reports, news and other (e.g. business) media, blogs, and NDM product websites and packaging[7]. In respect of the latter it is noted that although all NDM manufacturers promote plant based eating they are variably aligned with its most extreme form (i.e. veganism), reflecting differential ethical inclinations. The UK based company Plamil Foods (the MD of which is the son of Arthur Ling) emphasises on its website that all of its products are made in its own factory to enable it to meet the 'highest vegan standards' while the brand Rude Health recently antagonized vegans leading to a boycott (Chiorando 2017). Alpro has less to say about veganism directly but works hard to promote its environmental credentials, highlighting for example that more than half of its soya beans come from European countries, presumably to avoid connotations of South American soya being linked to deforestation (Alpro 2018).

The second round of research consisted of a small number (N=6) of semi-structured interviews with a range of UK stakeholders associated in different ways with NDMs including advocates for plant-based diets (e.g. vegan and vegetarian organisations), environmental groups

[7] 13 different types of NDM (in terms of their primary ingredient) were purchased from UK supermarkets and health food shops: Alpro, Blue Diamond, Ecomil, Good Hemp, Koko, Oatly, Plamil, Provamel, Provitamil, Rebel Kitchen, Rice Dream, Rude Health, Scotti.

and nutrition experts. Interviews were recorded and transcribed in full. Interviews took place following the initial documentary analysis (between August and October 2016) and served several purposes: 1) to elicit responses to the emerging insights from the documentary analysis – enabling identification of aligned but also alternative views and tensions across different aspects of NDM and dairy milk production and consumption, which could be further explored; 2) to 'fact check' data and trends identified from the secondary analysis; 3) to identify further useful sources of information which had not been identified.

In addition to these interviews a group interview (focus group) was also conducted with 6 UK consumers, in which the use, knowledge and ideas of NDMs, with particular reference to NDM marketing, product packaging, and public campaigns related to and NDM and dairy milk consumption were explored. While this single group interview cannot be considered representative of the opinions of the wider UK population it was instructive in relation to the range of issues and experiences considered important by consumers in terms of the relationship between NDM and dairy milk. These data are not presented in full in the paper but they did contribute to the identification of key arguments within particular frames.

All texts, both secondary and primary, were manually coded, compared against one another and then re-coded to formalise the identification and development of themes (Ryan and Bernard, 2003), including the identification of repetition, similarity, difference and contradiction (Bryman, 2015). This process of thematic coding enabled identification of three frames, the constituent elements of each of the frames (e.g. problem diagnosis, impetus for action and proposed solutions including changes in governance arrangements) and their associated actors. The number of frames revealed through the analysis is at the upper limit of the number of frames likely to be present within a debate according to Snow and Benford's (1988) approach.

Framing NDMs, dairy milk and food system sustainability

Two of the three frames identified are associated with 'pro' NDM positions albeit articulated in ways that are sufficiently distinct to justify the identification of separate frames. Further, the key actors mobilising each of these frames are different. However, it is acknowledged that there are overlapping interests and so these frames speak to and reinforce one another to some degree. A third, oppositional or 'counter' frame is associated with a 'pro dairy milk' position which challenges the other two frames and in doing so contests the process of substitution.

The 'down with dairy' frame

Arguably the most radical of the two 'pro NDM' frames identified yet by no means the most pronounced, the naming of this frame signals the prominent role played by a small number of NGOs that campaign on animal protection issues and promote plant based diets notably The Vegan Society, PETA (People for the Ethical Treatment of Animals), Viva and Compassion over Killing. For the actors associated with this frame the 'problem' lies in a food system that is based on the production and consumption of food from animals including dairy. This is both unethical on the grounds of 'speciesism' (Cole and Morgan 2011) and unnecessary given that these foods are not required to provide a nutritionally sound diet. That the production and consumption of dairy milk is unnatural is another dimension of this problem diagnosis. The impetus for action here is primarily the exploitation of animals within the food system although secondary drivers are the environmental and human health impacts. These secondary arguments overlap with those made in the other 'pro NDM' frame described below. The prognostic dimension of this frame envisages

dramatic, food system wide change away from the production and consumption of all foods from animals. The change required in the domain of consumption is for a shift to entirely plant based eating including, but not limited to NDMs and other substitutes.

A range of activities accompany the mobilisation of this 'down with dairy' frame. Citizen-consumers are a key audience for campaigns such as Viva's 'White lies' campaign which contests the dairy industry, and PETA's recent campaign that urges consumers to 'ditch dairy' and which controversially references research that links conditions such as autism to dairy consumption. Other work undertaken by the NGOs associated with this frame, and illustrated by information provided on their websites, is to raise awareness, inform and provide guidance to actual and potential consumers of the availability, taste and other (e.g. culinary) properties of NDMs and related new products such as non-dairy versions of cheese, ice-cream and yoghurt. In addition to their efforts to convince consumers and citizens of the value of NDMs, the NGOs associated with the 'down with dairy' frame are also engaged in campaigns targeted at the dairy industry and at policy makers. PETA writes directly to large commercial UK dairy producers urging that they transition away from dairy production to crops such as soy (PETA, 2016). Meanwhile the publication in 2016 by the Vegan Society of its 'Grow Green' report asserts that a significant shift away from livestock production is required if the UK is to meet new climate change targets. Specifically, the report demonstrates that production of crops for NDMs represents a viable commercial alternative for farmers that can also help to tackle climate change. Moreover, it suggests that a transition at the production level is needed to further improve the environmental efficiencies of NDMs while simultaneously supporting the UK's agricultural economy e.g. the report suggests that dairy farming can be replaced by UK grown hemp and fava beans both of which are used to make NDM. The Grow Green report's primary objective, however, is wider food system reform, emphasising a need for a "multi-sector approach and the cooperative work of different bodies and governmental departments" (Speranza and Marquès-Brocksopp 2015: 6). Pointedly, the report emphasises the need for action to 'reduce dependency on livestock' which, it is claimed, public policy and environmental NGOs have failed to achieve[8]. Interviewees also recognised that government support to encourage less consumption of dairy foods was low to non-existent: "I think they [government] like to ignore it a lot especially since the British dairy industry is big, it gets a lot of money in [to the UK economy]" (Interview 5, 2016). In short, the actors associated with the 'down with dairy' frame acknowledge that much more action needs to be taken at industry and policy levels to bring about a transition to a food system that is plant-based and within which the production and consumption of substitutes such as NDMs are one important dimension.

It is not the point of frame analysis to assess the quantitative 'extent' of this or any of the other frames. However, given that vegans currently constitute 1-2% of the population of the UK and US, and the concept of a food system completely without animals remains a radical one, the influence and reach of the 'down with dairy' frame is likely to be limited. Nevertheless, veganism has recently been growing rapidly[9] and enjoying more positive print and broadcast news media

[8] See, for example, the recent statement by the UK's Minister for the Department of the Environment, Food and Rural Affairs, Michael Gove, that meat is critical to a 'balanced diet' (van der Zee 2018) and the rebuke by a group of health professionals calling for more plant based eating (Kassam 2018).

[9] Research for the Vegan Society (2016a), for example, suggests that the number of vegans in the UK has increased from 150,000 to 542,000 between 2006 and 2016, representing over 1% of the UK's Population (see also Twine 2017). In the United States it is reported that 2% of the population is vegan (Newport, 2012).

attention than previously reported (Cole and Morgan 2011) and so it is not unreasonable to anticipate that this frame will become more prominent and influential in due course.

The 'non-dairy milks as healthy (planet) choice' frame

Less radical than 'down with dairy', but the most prominent in the analysis, this frame presents dairy milk as a food that can either cause specific human health problems or is generally less healthy than its alternative, NDM. Simultaneously, this framing identifies that livestock, and dairy production specifically , has a range of undesirable environmental impacts, particularly greenhouse gas emissions. The corollary is that both human health and environmental health gains can be realised from the increased production and consumption of NDMs. The health of the consumer and protection of the environment, particularly the global climate, provide the impetus for action. The solution is simple: avoid dairy milk, at least some of the time, and consume NDMs instead because these are healthier and less environmentally harmful. However, unlike the 'down with dairy' frame's diagnosis, there is no sense here that *all* animal food production-consumption needs to be questioned and by extension that the food system needs to be entirely animal free. Although the health and environmental implications of dairy consumption are challenged, this frame does not incorporate a *fundamental* critique of the food system as currently configured. Instead it speaks to a politically more palatable discourse of consumerism by offering consumers, who are required to alter their purchasing and eating behaviours only slightly, the *choice* of an additional, dairy like food that promises health and environmental benefits. This can be realised by either replacing or partially substituting dairy milk with NDM, thereby reducing consumption of the former.

Increased 'health awareness', including specific health issues such as heart health, weight loss, lactose intolerance, milk allergy and more diffuse and aspirational notions of 'healthy lifestyle' (e.g. the 'clean living' movement which promotes plant based eating (Wilson 2017)) are identified in market research and media reporting as the primary reasons for the large-scale use of dairy alternatives and NDM market growth (Market and Markets 2015; Mintel 2016). However, although Mintel (2016) report that nearly 50% of NDM users in the US in 2015 avoided dairy milk as part of a 'healthy lifestyle', 69% of US NDM consumers *interchangeably* consume both dairy milk and NDMs and 91% of the population consumes dairy milk. Similarly in the UK, despite the growth of NDM consumption 98% of UK households continue to have dairy products in their fridges (Quinn 2014). Such statistics underscore this frame's solution as providing consumers with more healthy choices when it comes to dairy (like) foods, enabling them to include NDMs in the diet alongside continuing, albeit probably reduced consumption of dairy milk. Interviewed vegans perceived non-vegan NDM consumers as using dairy milk and NDMs for different meals e.g. dairy milk on breakfast cereals, NDM in a 'healthy smoothie'.

NDM producers are prominent actors associated with this frame. Health claims were expressed across all NDM producer websites and packaging and were the most prominent of all the claims made. All NDM producers engaged with the idea that NDMs are a healthier alternative to dairy milk, claiming that these plant milks are lower in fat, sugars, and calories. For example, the oat milk manufacturer 'Oatly', highlights that "…where people continue to struggle to meet dietary recommendations for saturated fats and fibre, oats may be a welcome addition for those trying to improve their diet". Alpro also highlights the problematic nature of modern westernized diets, citing 'too much saturated fat', 'not enough fibre' and 'lack of variety', linking the health challenges with over consumption of animal proteins and the insufficient consumption of plant proteins. According to Shurtleff and Aoyagi (2013) Alpro, has been making explicit environmental claims about its soy based products since the early 1980s. Alpro's website and packaging asserts

that soy milk is 'good for you' and 'good for the planet' using "… less land and water and produce[s] less CO2 than dairy milk". The mobilisation of data by NDM producers in relation to greenhouse gas emissions and resource use is a prominent tactic in their claims about planetary health. For example, Oatly claims its production leads to two thirds less CO2 emissions than dairy milk. Interviewees were inclined to endorse such arguments. The claimed environmental credentials of NDMs also make reference to sustainable farming and distribution methods, use of 'cleaner' energy, recyclable packaging. For example, Provamel highlights its use of 'green energy' and shipping rather than air distribution, while Good Hemp (2016) emphasises the absence of waste in processing.. NGO engagement, as illustrated through links to NGO websites, is another way that NDM producers try to demonstrate their environmental legitimacy.

In making their health and environmental claims NDM producers mobilise scientific evidence, albeit sometimes implicitly. Nevertheless, science represents another actor associated with this frame. The sciences of animal and plant based eating have developed in recent years with some studies indicating the health and environmental benefits of a diet lower in animal and higher in plant sourced foods, with the latter including NDMs (e.g Scarborough et al. 2014; Hallström et al. 2015). Research has reported the significant contribution to greenhouse gas emissions from livestock production with dairy production contributing about a third of this total (e.g. Bailey et al. 2014). Scientific assessments have indicated that a plant-based diet is significantly more environmentally friendly than one based on animals (González et al, 2011; Westhoek et al, 2015; Springmann et al, 2016, Sabate & Soret, 2014). Studies which compare the environmental impacts of dairy and NDMs suggest soya and oat milk have significantly lower emissions of between 21-30g compared to 99g for dairy milk (per 100g) (Smedman et al. 2010).

Although referenced by some NDM producers in relation to their environmental claims, NGOs are notably less prominent actors compared with the other two frames... This may be explained by an observed reluctance on the part of environmental NGOs to tell people what to eat (Laestadius et al. 2014). One exception is Friends of the Earth (FOE) and its campaign 'Healthy Planet Eating' (2010) which links livestock production to a number of environmental ills. Although the campaign's focus is on meat reduction, it also suggests dairy intake needs to be lowered to support public health outcomes. Unlike the animal protection NGOs associated with the 'down with dairy' frame, however, FOE recommends a reduction (cf. elimination) in consumption of foods from animals entailing better quality, non-factory farmed produce within the context of a "sustainable livestock strategy" (FOE, 2010).

The 'healthy (planet) choice' frame is mobilised by a wide range of actors drawing on multiple forms of evidence and this breadth may help to explain its current prominence within the debate surrounding NDM production and consumption. Here, the substitution of dairy milk by NDMs (which is most likely to be partial, flexible and contingent) is positioned as an 'easy win' for both human and planetary health.

The 'dairy is best' frame

This frame directly opposes the other frames, with the problem definition that NDMs are becoming more widely consumed and taking market share from dairy milk, to the detriment of both dairy milk producers and consumers. Motivating the actors associated with this frame are an interconnected set of beliefs and interests that position dairy milk as superior to NDMs nutritionally and environmentally, and concern about the economically precarious position of dairy farming across a number of country contexts (e.g. Davies 2015). In short, dairy milk is conceptualised as the more sustainable option than NDMs. Consumers, it is believed, need to be

reminded of the 'naturalness' and 'healthiness' of dairy milk, to support and sustain the dairy industry and ensure their own health. This is summed up by the DairyCo UK statement that dairy milk is "a consistent consumer favourite with well-known nutritional benefits and as an essential part of a healthy diet" (Quinn 2014).

That the dairy industry and its various representatives are the main actors associated with this frame is no surprise. Since NDMs began to be commercially produced in the early-mid 20th century the dairy industry has resisted their marketing, with action focused on the description and labelling of NDMs as 'milk'. The first legal action taken against soymilk's imitation of dairy occurred in the US in 1949 and later the National Milk Producers Federation (NMPF) made claims against incorrect identity standards for soymilk (FDA, 2000; Shurtleff and Aoyagi, 2013). Currently, efforts continue to be made by the NMPF to enforce US legislation which limits the use of the term 'milk' to products derived from animals on the grounds that NDMs are unfairly profiting from its use, at the expense of dairy milk producers (Shilton 2017). In Europe, in a recent case that attracted international media attention, the Swedish producer of Oatly was taken to court in 2014 by Sweden's Dairy Lobby, LRF Mjölk, who claimed that Oatly's marketing disparaged dairy as unhealthy (Gustafusson, 2015). Unfortunately for the dairy lobby this controversy lead to increased sales in Sweden of this NDM with a revenue boost of 45% (Gustafusson 2015).

Further evidence of support for the 'dairy is best' frame comes from the UK's Dairy All Parliamentary Group (DAPPG) which recommended recently to the Department of Health that it should instigate a 3-a-day programme for dairy, based on the 'essential nutrients it affords' (Dairy UK 2016). The group's report 'Putting Dairy Back on the Daily Menu' urges an increase in consumption of dairy for vulnerable age groups, both for health but also for the environment. It identifies that in the last few years there has been "a small surge of plant-based alternatives to dairy, most of them boasting of a better nutritional, environmental and economic impact than dairy foods. However, upon closer examination, it seems that dairy fares better than its alternatives" (DAPPG 2016: 9). The report asserts that replacing dairy with NDMs would have undesirable impacts on nutrition, increase calorie intake and bring environmental costs[10]. However, the complexity of measuring the comparative environmental costs of dairy milk and NDM production is acknowledged. The DAPPG's position is indicative of the historically successful political capture achieved by the meat and dairy industries within Europe and the US (e.g. Robinson-Simon) one consequence of which is the direct subsidising of meat and dairy production and marketing (Change.org 2018).

Also associated with the 'dairy is best' frame are public health and nutrition science actors. For example, although national nutrition guidance in the form of Public Health England's 'Eat Well Guide' acknowledges that NDMs can form part of a healthy diet, it does not advocate that they replace dairy even though it recommends a reduction by 50% from the level specified in its previous guidance of daily calorie intake from dairy foods (Nagesh 2016). Meanwhile, national nutrition guidance in the US advocates *increased* consumption of dairy milk for protein and calcium intake (U.S. DoHHS Services 2015; U.S. DoA 2015). The the US Academy of Nutrition and Dietetics, which represents nutrition professionals, is supporting a US dairy industry 'Get Real' campaign. This initiative has been designed to address declining consumption of dairy milk[11]

[10] Questions about the environmental impacts of particular NDMs (e.g. the use of water in almond production) have also been raised elsewhere (e.g. Saner 2015) but the comparative impacts of NDMs and dairy milk are hotly contested and complex (Gustin 2018).

[11] In the US Mintel (2016) report decreased **sales of dairy milk of 7 percent in 2015 ($17.8 billion) with a projected further drop of 11 percent to 2020.** Other data reveal that per capita consumption of dairy milk in both

(also observed in other countries of the global north) and the rise of NDM consumption, to underscore "the decades of research reinforcing low-fat milk as one of the most nutrient-rich beverages available" (Daily Mail 2015). According to one university based nutrition scientist no milk, either dairy or plant-based is "wholly healthy or unhealthy" (Gander 2016). Such comments reflect a wider discussion in nutrition science about whether diets free from dairy, which are acknowledged as having some benefits, can meet nutritional needs (Craig, 2009). Given this public health and nutrition science guidance it is unsurprising that other health professionals might be wary of recommending NDMs, other substitutes for food from animals and plant-based eating more generally. As a UK Vegetarian Society representative observed when interviewed: "the number of GPs that think a vegetarian diet is unhealthy…. (F)or plant milk that could be problem. People do the old-fashioned thing, to fall back on milk as a health food". This suggests that the framing of 'dairy is best' remains entrenched amongst many health professionals. In short, substitution has no meaningful place in this frame.

Discussion and conclusions

This paper has presented a frame analysis of the debate surrounding the production and consumption of plant-based alternatives to dairy milk as this is taking place within the UK but also other countries in Europe and North America. It has done so in order to explore how food system actors position themselves around substitution and what this might mean for food system de-animalisation. The study of frames is intended to illustrate how these have consequences for action. The analysis has revealed a 'down with dairy' frame which offers the most fundamental and far reaching critique of the incumbent food system in which NDMs substitute completely dairy milk. Civil society organisations feature prominently within this frame, actively promoting NDMs as one dimension of plant-based eating driven primarily by a concern to end animal exploitation. The 'NDM as healthy (planet) option' frame asserts the health and environmental benefits of drinking NDMs and reducing but not necessarily eliminating dairy milk production and consumption. As such, substitution is envisaged as partial and contingent. A diverse set of actors are associated with reproducing and promoting this dominant frame including health conscious and environmentally concerned consumers, NDM producers, scientists and to a lesser extent environmental NGOs. The 'dairy is best' frame contradicts these framings and offers space for pro-dairy milk and anti-NDM arguments and actions, asserting that dairy milk continues to offer the most sustainable option (economically, environmentally and socially) both for producers and consumers. Substitution is a threat in this framing. The dairy industry, some government actors together with nutrition science and health professionals are aligned with this frame. In the remainder of this final section, the results of the frame analysis are drawn upon to make two key points about substitution and food system de-animalisation. In doing so it also identifies a number of future research avenues.

The rise of NDMs appears to be playing a role in stimulating a fresh politicization of dairy milk that is distinctive to an older, more production oriented politics characterised by a series of increasingly widely reported problems including declining milk prices, producer-retailer relationships, cattle diseases (notably bovine TB), and a fall in the number of dairy farms (Davies 2015). This new politics of dairy milk is revealed in the divergences and conflicts between the three frames. Importantly, it entails an opening up of the black box that previously left unquestioned why dairy is consumed in the first place and whether, or to what degree, it should be

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the US and UK is in long term decline (e.g. https://www.ers.usda.gov/data-products/food-availability-per-capita-data-system/; accessed 18 December, 2017).

consumed. Dupuis (2002) also identifies a new politics of milk associated with the controversial introduction into the dairy industry of recombinant Bovine Growth Hormone in the US in the 1990s. However, her analysis does not include dairy milk substitutes, focusing instead on the emergence and growth of the organic dairy milk sector.

In the current context the new politics of dairy milk is associated with debate and controversy about milk's *consumption* and entails a challenge to dairy milk's dietary dominance. This challenge speaks to a role for substitution that extends beyond a de-animalisation pathway of 'mere substitution' and 'sustainability by stealth' associated with a recalcitrant group of dairy consumers committed to eating large amounts of foods from animals and who are little interested in claims of health or environmental problems. Although this group of consumers may well be persuaded to engage with de-animalisation by replacing a small proportion of their dairy milk consumption with an NDM, frame analysis suggests that dairy milk substitution is mobilising a wider range of actors including those advocating that dairy is 'ditched' completely. That being said, it is the 'NDMs as healthy (planet) choice' frame that appears to be the most prominent and it is the frame that maps comfortably onto a de-animalisation pathway equivalent to that of de-Bakker and Dagevos's (2012) 'moderate involvement' and Sage's (2014) 'flexitarianism'[12]. As such, it is concluded that substitution, at least as this concerns dairy milk, has a role to play within the middle way pathway of de-animalisation rather than being uniquely associated with a pathway of 'reluctance'. Further research into the politics of meat substitution, that would complement the analysis herein and build on the preliminary work by Sage (2014), would usefully reveal whether this conclusion can also meaningfully encompass meat.

The second point of conclusion concerns the implications of the frame analysis for the governance of de-animalisation. Although frames indicate how a group understands the problem at stake should be governed, explicit reference to institutional action is not a consistent feature of the frames identified. Nevertheless, it is apparent the key food governance domains of the state, market and civil society (Renting et al. 2012) are being unevenly implicated in the governance of plant-based eating of which substitution is one element. A small number of civil society actors have been important NDM entrepreneurs, and continue to act in association with a 'pioneering' pathway to de-animalisation, as evidenced in the 'down with dairy' frame. However, it has been a range of market based actors - producers, investors, consumers - that have been key to the rise of NDMs. As such, substitution can be understood as currently a predominantly market based contribution to de-animalisation. Meanwhile, state actors have been much less conspicuous, with a notable lack of public policy intervention in supporting plant-based eating. This is an omission that was highlighted by NGOs associated with the 'down with dairy' frame. The precise role for public policy actors within de-animalisation requires more detailed consideration. Although Sage (2014: 199) argues in relation to de-meatification that this process needs "serious engagement from public policy makers" for others "it is not self-evident that government authorities take the lead. They can also operate in the background, for example by facilitating parties (NGOs and/or market enterprises) that are promoting a food culture of eating less meat" (de-Bakker and Dagevos 2012: 885). With respect to milk it is arguably the 'dairy is best' frame that currently has most traction within public policy domains with the long history of public subsidy to dairy farming reinforcing this point. That said, in the UK specifically a number of developments suggest that the pro NDM frames, which endorse substitution as a strategy, are beginning to have some impact in the national

[12] This term is usually applied to meat eating but could apply equally well to the consumption of dairy foods, although this would bear further consideration.

state governance domain. These include the reduced emphasis on dairy foods in national nutrition guidance, the recent establishment of an All Parliamentary Group on Vegetarian and Vegan diets (The Vegan Society, 2016b), and a lively media debate surrounding NDMs which is indicative of positive societal engagement with plant-based eating more generally (Lowbridge 2017; Morris 2018).

Negotiations over public support for a post-Brexit food system provide potential opportunities for UK based actors associated with the pro NDM frames and represent another future research avenue. For example, work could examine the institutional and behavioural barriers and opportunities for incentivising 'home grown' NDM production as part of a wider restructuring of the dairy industry. This reinforces the suggestion made by Vinnari and Vinnari (2014: 387) that "public policy could focus on providing incentives for companies to develop plant-based protein sources that suit national cultivation conditions". Finally, there is scope for more detailed investigation into the eating of substitutes for food from animals. However, rather than focusing on the 'behavioural change' of groups of consumers (e.g. recalcitrant over-consumers of meat / dairy or enthusiastically engaged vegans) research could draw on the increasingly influential practice theoretic insights into sustainable consumption (e.g. Warde 2014) to explore the variable ways in which eating practices associated with substitutes arise and evolve over time and space. This would build on work undertaken by Twine (2017) on the role of substitutes in vegan practice, extending this to other groups of eaters who are following various types of omnivorous, e.g. meat reducing (Mylan 2018) and vegetarian diets. A practice based approach to substitution moves the focus away from explaining the likelihood of engaging in substitution as characteristic of particular groups of people or particular de-animalisation 'pathways'. Together these research efforts would contribute to addressing the challenges of governing the de-animalisation of the food system including, but not limited to the role of substitution within this process.

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