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Abstract

This paper reviews available cross-disciplinary evidence on how culture affects food security. We discuss the impact of culture on all four dimensions (availability, access and choice, utilization, and stability). Although there is large heterogeneity in the size and breadth of available evidence, with research often biased toward high-income countries, it is clear that how and why we obtain, process, prepare, and eat food is influenced by culture in various ways. In addition, gender, family, and decision-making power play a critical role in the impact of culture. The dynamics of culture as well as the magnitude and relative importance of cultural effects in the context of food security are still poorly understood. Nevertheless, there remains ample scope for improving food security policy by taking culture better into account.

Keywords: Culture; Food security; Nutrition

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1. Introduction

Food is not only a source of nutrition, but plays various other roles in human society and is intimately linked to culture (e.g. Feeley-Harnik, 1995; Fieldhouse, 1995; Kittler et al., 2011; Mintz and Du Bois, 2002). Examples of well-intended interventions that have failed because they did not take cultural settings into account are plentiful and range from rejected deliveries of culturally inappropriate food aid to disregard for dietary recommendations that conflict with the cultural meaning of certain foods (e.g. Allen and Gillespie, 2001). Improving our understanding of the cultural dimension of food security is therefore increasingly recognized as an essential part of moving towards sustainable healthier diets for all (e.g. Helman, 2007; Keding et al., 2013; UN, 2013). This evolution is reflected in the fact that culture is now commonly mentioned as one of the ‘*deep drivers*’ of food security in conceptual frameworks (e.g. WFP, 2012). Yet, in spite of this growing recognition, culture has too often remained on the fringes of discussions on the fight against malnutrition among researchers as well as policy-makers. The frameworks that identify culture as an important driver in fact rarely clarify through what specific channels it affects food security, nor how important its influence is relative to other factors. Put differently, it has been widely acknowledged that culture matters, but the questions of *in what ways* and *to what extent* it matters remain largely unaddressed.

To some extent, this lacuna may be related to difficulties in operationalizing and measuring such a comprehensive concept (Alesina and Giuliano, 2015; Guiso et al., 2006). Yet, various disciplines have made significant progress in developing theories, models, and instruments to analyse and measure culture qualitatively and quantitatively (see e.g. Taras et al., 2009). In addition, there is a vast and growing body of literature investigating different aspects of culture in relation to several dimensions and drivers of food security. The problem is therefore not absence of research. The issue may rather be that research is scattered across a wide range of disciplines (from anthropology to biochemistry), topics (from food taboos to marketing), and types of research.² This dispersion makes it difficult to take stock of the current state of knowledge regarding the impact of culture on food security.

To our knowledge, this paper will be the first to provide an overview of available evidence on how culture affects food security by bringing together these distinct types of research from a range of different disciplines. Since the body of relevant literature is vast, the first step in this

² One type of studies reviews the impact of cultural factors on one or a few specific drivers of food security across countries – although the focus is often on high-income countries (e.g. Nestle et al., 1998). Another type of research takes the form of detailed case studies on how culture affects a large number of food security drivers for a particular cultural group (e.g. Gittelsohn et al., 2003). These studies generally take a broad approach in terms of cultural factors considered, but have a limited focus in the sense that they are highly specific to the population under study.

process is to delineate the scope of our review. We focus on the impact of culture on the determinants of dietary intake at the household and individual level.³ Our aim is to describe existing strands of research in this area, and how the current state of knowledge can inform policy making. Although we have tried to use a broad, interdisciplinary approach to account for the complex and multifaceted nature of both culture and food security, as economists we rely strongly on language and concepts common in our field.

We structure our review as follows. Section 2 elaborates on the question of how to define culture and food security. Section 3 reviews the different channels through which culture affects food security. In section 4, we discuss the role of gender, family, and decision-making power. The dynamic aspects of culture and drivers of change, including the role of mass media and marketing, are explored in Section 5. Section 6 concludes and presents implications for policy and future research.

2. Definitions of Culture and Food security

2.1. Culture

In the words of Alesina and Giuliano (2015: 899): “*Defining culture is an arduous task*”. There is no universally accepted definition, and different disciplines have defined this complex construct in numerous ways. While some interpretations focus on the core concepts of values, beliefs, and norms, others view culture more broadly as all socially transmitted information, each approach having its strengths and weaknesses.⁴ Indeed, the question of how to define culture in itself can be the subject of a review. Given the broad and interdisciplinary nature of this review, we therefore refrain from giving a strict definition. Rather, we continue by discussing a number of points that we deem important for clarifying and delineating our understanding of culture in this paper.

First, we see the social transmission of information as a crucial aspect of culture. Specific culture traits such as values, beliefs, and behavioural norms can be thought of as ways of transmitting information, both within and across generations, about how the world works and what is good and bad, right and wrong, or valuable and invaluable. Such culture traits and the information

³ By restricting our attention to the household and individual level, we leave aside macro-level effects such as the impact of aggregate food preferences on food trade patterns.

⁴ The first approach is common within economics, as is illustrated by the definition used by Gorodnichenko and Roland (2010: 1): “*the set of values and beliefs people have about how the world (both nature and society) works as well as the norms of behavior derived from that set of values*”. The psychological literature tends to emphasize the role of culture in motivating human behaviour. Matsumoto and Juang (2013: 15) for instance define culture as “*a unique meaning and information system, shared by a group and transmitted across generations, that allows the group to meet basic needs of survival, pursue happiness and well-being, and derive meaning from life*.” Other strands of research, including bio-cultural evolutionary work, stress the informational content of culture. Boyd and Richerson (2004) for instance define culture as “*information that people acquire from others by teaching, imitation, and other forms of social learning*”. We refer to Alesina and Giuliano (2015) and Taras et al. (2009) for a more extensive discussion on the definition and measurement of culture.

embedded therein aggregate into cultural models that explain a certain aspect of life (e.g. pregnancy, infant feeding, or illness) and mediate and regulate associated behaviour (D'Andrade and Strauss, 1992; Fryberg and Markus, 2007). Research on culture and food security often gives importance to a particular type of culturally embedded information that is built on long periods of experimentation, observation, and learning across generations (Becker and Ghimire, 2003; Berkes, 2012; Mazzocchi, 2006). To distinguish this type of information from knowledge acquired through modern scientific methods, various terms are used, including *traditional knowledge*, *indigenous knowledge*, and *local knowledge*, each having its own imperfections. We use the term 'traditional knowledge' throughout the paper to emphasize the process of knowledge building and transmission along a cultural continuity (Berkes, 2012; Mazzocchi, 2006).

A second important aspect of culture is its dynamic nature. Although culture can be remarkably persistent, it is inherently evolving, as it is shaped and reshaped by the social, political, economic, and ecological environment and in turn (re)shapes this environment. To take a specific example, traditional knowledge is not a static or fixed body of information, but should rather be understood as a dynamic learning process that responds to changing circumstances and needs of the group (Becker and Ghimire, 2003; Berkes, 2012).

The third point is aptly described by Weisner (2000: 142): "*Cultures may have a clear central tendency and normative pattern, but they are hardly monolithic and uniform.*" In practice culture is a heterogeneous mix of different cultural models that may concur or conflict with each other. Hence, one can find substantial cultural differences within relatively small groups, and intra-group differences are generally larger than inter-group differences (Shweder, 2000). This feature of culture highlights the importance of detailed micro-level research in understanding the relation between culture and food security.

Finally, a major challenge in conceptualizing culture is identifying its boundaries. For this review, two boundary areas are of importance: the relation between culture and institutions, and between culture and religion. Religion has proven even more difficult to define than culture, and their relation remains a topic of debate. Some scholars see religion as part of culture (e.g. Geertz, 1993; Richerson and Christiansen, 2013), while others argue that there are clear conceptual differences (e.g. Bonney, 2004). Since it is difficult to distinguish between religion and culture in much of the research relevant for this review, and the traits typically associated with religion fit well with our understanding of culture (cf. Bowie, 2003; Dow, 2007; Iannaccone, 1998), we follow the first approach and treat religion as part of culture. As for institutions, we follow Alesina and Giuliano (2015) and consider informal institutions (e.g. social norms) as part of culture, but not formal institutions.

2.2. Food security

Like culture, food security is a multi-dimensional and flexible concept that has been defined in various ways. For this review, we use one of the most widely accepted definitions, adopted by FAO in 1996 and refined in 2001; “*Food security is a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life*” (FAO, 2002). At the 2009 World Summit on Food Security, the four ‘pillars’ of food security were defined as *availability*, *access*, *utilization*, and *stability* (FAO, 2009).

Food availability focuses on the supply side and refers to the extent to which sources of nutrition are physically available through (local) food production and trading. *Food access* in turn points to the household’s or individual’s ability to obtain the food that is available. We pay particular attention to *food choice* within the discussion of food access because the ability to obtain food does not necessarily translate into actual acquisition (Pinstrup-Andersen, 2009). In this review, *food utilization* encompasses food processing and preparation. Finally, *stability* is the temporal dimension of food security and includes both the likelihood of experiencing shocks and the ability to recover from them.

It is important to acknowledge that conceptualized in this way, individual food security is a necessary but not sufficient condition for adequate nutrition. As outlined in the UNICEF malnutrition framework (Black et al., 2008), nutrition status is the result of the interplay between food and nutrient intake and health. However, as the effects of culture on health have been discussed elsewhere (e.g. Helman, 2007; Koenig et al., 2012; Spector, 2002), we limit the scope of our review to the impact of culture on the determinants of dietary intake only. In addition, we focus on direct drivers, leaving aside indirect effects of culture through underlying deeper determinants such as political institutions or economic growth – whose relation with culture has been reviewed elsewhere (e.g. Alesina and Giuliano, 2015; Gershman, 2016; Iyer, 2016; Spolaore and Wacziarg, 2013). Given its importance as a determinant of food access, Section 3.2 however briefly discusses available evidence on the impact of culture on income growth.

3. Culture Affects Food security in Various Ways

We organize our discussion of the impact of culture on food security along the lines of the four ‘pillars’ discussed in Section 2.2. In practice, there may not be a strict separation between these pillars, as there are interactions and overlaps between channels of impact discussed under the different pillars.

3.1. Availability

First, *what* food is produced and traded depends on what is classified as food. Culturally transmitted classifications of available sources of nutrition as food and non-food determine what potential foods are included in the regular diet (Fieldhouse, 1995; Helman, 2007) and thereby influence the composition of local food production, sales, and trade. It is worth noting that such classifications are crucial for the effectiveness of food-based interventions. Englberger (2012) for example reports that a government program in Micronesia aimed at reducing vitamin A shortages failed because it promoted the consumption of green leafy vegetables, which were seen as fodder rather than food for human consumption.

Second, culture shapes *how* food is produced. A growing body of research has analysed the impact of traditional food production⁵ systems and the knowledge embedded therein on food availability (e.g. Altieri, 2004; Clawson, 1985). A noteworthy finding of several studies is that certain traditional crop combinations offer agricultural complementarities in the form of resource sharing or protection against environmental stresses (Kumar and Nair, 2004; Milburn, 2004) and a number of traditional crop selection and pest management systems are well adapted to local environments and risks (Abate et al., 2000; Altieri, 2004; Clawson, 1985; Jaenicke and Höschle-Zeledon, 2006). In addition, several traditional production practices have been documented to result in high agro-biological diversity (Altieri, 2004; Clawson, 1985), which can facilitate dietary diversity (Bélanger and Johns, 2008; Penafiel et al., 2011). It is important to note, however, that traditional food production systems need sufficient food safety checks to monitor the risk of exposure to toxins, either organic (Benkerroum, 2013; Wild and Gong, 2010) or inorganic (Isildak et al., 2004; Larsen, 2006; Muhammad et al., 2011).

Box 1: The Native American ‘three sister’ food system

Based on the belief that the spirits of the ‘three sisters’ belonged together, the Six Nations people traditionally planted maize, beans and squash together. Agriculturally, this integrated agro-ecosystem has many advantages (e.g. Altieri, 1999; Postma and Lynch, 2012; Risch, 1981). Maize has high nitrogen requirements, and beans bring atmospheric nitrogen into the soil with the help of symbiotic bacteria. The maize stalks in turn provide structural support to the climbing bean plants. With their large round leaves, squash plants shade the soil and as such help conserve moisture and reduce weeds. Integrated plantings also reduce pest problems.

Source: Milburn (2004)

Since agricultural technology adoption takes place in a social context, culture will also influence producers’ acceptance of new food technologies and their willingness to incorporate

⁵ Traditional food production refers to the production of foods in a traditional manner (not to the production of so-called traditional foods). We see it as a system that relies on the natural resources available to the group; that has existed for a long period of time; and where production and the embedded knowledge is socially transmitted within the cultural group.

innovations in food production (Vanclay, 2004). The success of farmer field schools for Filipino rice farmers has for example been attributed to the presence of cultural norms that encourage experiential and collective learning (Palis, 2006).

The efficiency of food production systems in ensuring the availability of sufficient and nutritious foods further depends on post-harvest losses and waste of food. How food is processed and stored is strongly determined by culturally transmitted food processing and storage techniques (e.g. Cardoso et al., 2005; Chipungu et al., 2012; Kittler et al., 2011).⁶ More generally, cultural models of eating may drive food waste behaviour. Public discourse often refers to the emergence of a *'throwaway society'* in higher-income countries where food waste is commonplace (Evans et al., 2012; Godfray et al., 2010). Yet, the cultural drivers of food waste are strikingly understudied, and available research strongly focuses on industrialized countries (Blichfeldt et al., 2015; Evans, 2011; Evans et al., 2012).

3.2. Access and choice

Even when food is physically available, food and nutrient intake will depend on a household's and individual's ability to obtain that food. Two major dimensions of access to food are economic access and social access.

Economic access to food is largely determined by income. The relation between culture and (long-run) economic growth has been reviewed elsewhere (Gershman, 2016; Iyer, 2016; Spolaore and Wacziarg, 2013). These studies generally conclude that there is "*a key role for persistent traits transmitted across generations within populations in explaining development outcomes over the very long run*" (Spolaore and Wacziarg, 2013: 17). However, it remains difficult to empirically disentangle the effects of culture traits from the effects of other characteristics of human populations, locations, and societies on long-run economic development (Spolaore and Wacziarg, 2013). To our knowledge, the micro-level effects of culture on income have not been systematically reviewed. Available evidence suggests that the relation is highly heterogeneous across a wide diversity of settings, culture traits, and channels of impact (e.g. Ager et al., 2014; LeMay-Boucher et al., 2013; Stifel et al., 2011). Bettendorf and Dijkgraaf (2010) for instance find that church membership and other measures of religiosity have different effects on income for high- and low-income households within countries. Hence, the current evidence base does not seem to allow us to draw any general conclusions about the impact of culture on household and individual food access through its effects on income.

⁶ The properties of traditional food processing and storage techniques are analogous to the properties of traditional food production and are discussed in more detail in Section 3.3 on the use of food.

By influencing social inclusion or exclusion, culture shapes social access to food as well. The social transmission of beliefs about groups and individuals (e.g. in the form of stereotypes) can lead to stigmatization and discrimination, and in severe cases result in marginalization through the structural exclusion from social and economic life (Mahajan et al., 2008; Parker and Aggleton, 2003). Some work has for example documented the exclusion of groups and individuals from food assistance programs (e.g. von Braun and Thorat, 2014). Food access can also be undermined through exclusion from regular food acquisition strategies such as food shopping or food production, but this effect has not been systematically researched. In contrast to a large and growing literature on the implications for health (Gabrysch and Campbell, 2009; Mahajan et al., 2008; Smedley et al., 2002; Williams and Mohammed, 2009), less attention has gone to the implications of social exclusion for food security. The situation of indigenous peoples merits particular attention in this respect (King et al., 2009; Stephens et al., 2006).⁷ Although data is limited, indigenous peoples appear to be worse off in terms of food security in any country (Kuhnlein et al., 2006a). In Honduras, for example a staggering 95 % of indigenous children is estimated to suffer from malnutrition. Similarly, the rate of stunting in indigenous communities in Guatemala, El Salvador and Ecuador was found to be almost twice as high as the rate among non-indigenous children (UN, 2009). The marginalized status of indigenous peoples is often named as one of the causes of this nutrition gap, but an improved understanding of the role of social exclusion is severely hampered by a lack of systematic data.

Culture also affects individual access to food through intra-household food distribution. In general, how food is distributed within the household depends on the nutritional and cultural value of different types of foods on the one hand, and the ‘needs’ or ‘contributions’ of household members on the other hand (Engle and Nieves, 1993; Haddad et al., 1996). The assessment of household members’ needs and contributions depends on several factors, including culture traits such as the perceived value of different types of work and responsibilities (Denney et al., 2014; Gittelsohn et al., 1997). There is consensus on the fact that males are often favoured over females, which can negatively affect food access for girls and women in poor households (e.g. Gittelsohn et al., 1997; Haddad et al., 1996).

Access to food may be further affected by practices regarding how much and what kind of food to offer during feasts or to guests, in particular at large social events such as weddings or funerals (Fieldhouse, 1995). Especially when such practices oblige households to decrease food stocks or slaughter livestock, longer-run household food security could be undermined. A telling

⁷ The definition of indigeneity is complex and contested. We refer to the topical literature (e.g. Stephens et al., 2006) for a detailed discussion.

example comes from Peru, where government food aid targeted to children was served at community dinners honouring out-of-town guests (ACF, 2010). However, in other cases festivities stimulate the consumption of nutrient-rich foods (e.g. Sho, 2001), thus contributing positively to food security. Research on the effects of feasts and festivals on food access remains scarce. Some anthropological work suggests that festivals may actually be a form of institutionalized food redistribution to the poor (or to the rich) (Dietler and Hayden, 2010; Fieldhouse, 1995; Greenberg, 1981).

Cultural models of eating also specify how, when and where one should eat and what constitutes a 'proper' meal. By shaping meal and eating patterns, such models have an important effect on what food is accessible and what food we choose to eat (Atkins and Bowler, 2001; Fieldhouse, 1995; Kittler et al., 2011). Studies of resettled refugees show that the confrontation with unfamiliar cultural models of eating can present significant barriers to food security, in the form of difficulties in navigating the new food environment and preparing unfamiliar foods (e.g. Hadley et al., 2007; Morris et al., 2009; Sheikh-Mohammed et al., 2006).

Socially transmitted food prescriptions (what should be eaten) and proscriptions (what should not be eaten), including food taboos, can affect social access to food and food choice. Such food pre- and proscriptions (collectively referred to as dietary rules) are derived from food classifications according to different criteria, including associated social status, perceived healthiness⁸, or sacredness (Helman, 2007).⁹ There is large heterogeneity in the type, importance, and impact of dietary rules across and within cultural groups. Even food taboos are not always absolute and can be specific to certain individuals and circumstances (Meyer-Rochow, 2009). Pregnancy, the postpartum period, and infancy are for instance commonly characterized by dietary rules for women and infants (Kim-Godwin, 2003; Piperata, 2008). Though pregnant and lactating women in various parts of the world are forced to abstain from especially nutritious and beneficial food (Barennes et al., 2009; Hartini et al., 2005; Santos-Torres and Vásquez-Garibay, 2003), some studies find that nutrition or energy intake is actually promoted (e.g. Kaewsarn et al., 2003; Wiley, 2002) or the effects are mixed (e.g. Piperata, 2008; Sein, 2013; Steinberg, 1996).

Overall, the impact of dietary rules seems to be highly context-specific. A case in point is the impact of religious dietary rules: certain diets and fasting rituals were found to restrict the consumption of foods that are unhealthy in obesogenic environments, while other food-related

⁸ Whether a food is classified as healthy or unhealthy can be based on beliefs about nutritional value or broader salutary or detrimental effects on the body, mind or community (Helman, 2007).

⁹ The distinction between food taboos and non-food classifications is not straightforward. Many studies conflate food taboos and food proscriptions, but we prefer to make the distinction because there can be important differences in terms of the strength of underlying norms and enforcement.

religious practices had little effect or may be harmful in case of illness, pregnancy, or when access to substitutes is limited (Sabaté, 2004; Trepanowski and Bloomer, 2010).¹⁰

In general, the extent to which dietary rules effectively influence behaviour will determine their impact. This in turn depends on how strictly compliance with the behavioural implications of culture traits is enforced. When dietary rules are flexibly enforced, they affect food choice, as compliance will depend on one's assessment of the costs and benefits of observance (Denney et al., 2014; Lee et al., 2009; Raven et al., 2007). These practices can however generate strictly enforced social norms that hamper access to foods that would otherwise be available and economically accessible (e.g. Meyer-Rochow, 2009; Nwajiuba and Okechukwu, 2006). Besides strong social pressure, strict enforcement can result in a strong internalization of the culture trait as well. Fessler and Navarrete (2003) for instance describe how people's initial explanation as to why an animal is not eaten (e.g. pig among many Muslims) is a feeling of disgust, rather than an explicit taboo or symbolic value.

Box 2: Strictly enforced taboos for pregnant women in Ghana

In rural Ghana, pregnant women are forbidden to eat various foods including snails, rats, snakes, hot foods and animal lungs. These taboos are seen as instructions from god passed down from generation to generation to safeguard them against evil and diseases. Disobedience is considered blasphemous and believed to lead to anger of the ancestors, which can put the community and the health of mother and child at risk. Pregnant women are therefore continuously reminded about the taboos and those who break them are constantly frowned upon or even excommunicated from the family or community.

Source: Arzoaquoi et al. (2015)

Compliance and enforcement can be flexible to varying degrees. Ramadan fasting offers an example of formalized individual flexibility: pregnant, menstruating or breastfeeding women are required to defer fasting to a later time to protect their health and that of the foetus or infant (Laway and Ashraf, 2015)¹¹. In other cases, flexibility takes the form of tolerance for non-compliance as long as behaviour remains in accordance with underlying cultural models. An example is the compensation of food taboo violations by performing neutralizing rituals or eating foods that counteract the negative effects of the violation (Bentley et al., 1999; Meyer-Rochow, 2009). When external enforcement is strong but internalization weak, people may resort to various strategies to circumvent external enforcement, such as secret non-compliance (e.g. Bentley et al., 1999).

¹⁰ Ramadan fasting for instance does not seem to have any major effects on food security for healthy individuals, but may have negative consequences in case of illness (Leiper et al., 2003; Roky et al., 2004; Sabaté, 2004) or pregnancy (Almond and Mazumder, 2011; van Ewijk, 2011).

¹¹ Local beliefs and norms may still override these formal rules and enforce the participation of all adults, including pregnant women (Almond and Mazumder, 2011).

There has been a rising interest in the role of traditional dietary knowledge in shaping food choice and combatting malnutrition. A substantial body of research has studied traditional diets and the embedded dietary knowledge (e.g. Kittler et al., 2011; Kuhnlein et al., 2009; Trichopoulou et al., 2007). It is now widely recognized that a large number of traditional foods¹² have high nutritional value and are important contributors to nutrition for communities worldwide (Benkerroum, 2013; Burlingame, 2000; Grivetti and Ogle, 2000; Roche et al., 2008; Trichopoulou et al., 2007). Failure to safeguard access to their traditional foods has also been identified as a major driver of poor food security outcomes of indigenous peoples (Kuhnlein et al., 2006a; King et al., 2009; UN, 2015). More generally, indigenous peoples' food security is undermined by the loss of bio-cultural resources that are the foundations of their diet.

Box 3: The benefits of 'little millets'

A species of millet (*Panicum sumatrense*), known as 'little millets' is one of the oldest food grains known to humans and grows well in dry zones, producing crops even on very poor soils. These grains form a traditional staple food for low-income groups in some South Asian countries (Pradeep and Guha, 2011), where they are processed into healthy snacks or nourishing flour that can be mixed with rice flour, offering longer shelf-life. The millets are rich in vitamins, phenolic acids, calcium and iron and contain more soluble fibre than rice or wheat. Moreover, the little millets also have a low glycaemic index, making them attractive health foods.

Source: Jaenicke and Höschle-Zeledon (2006)

Although more research is needed to corroborate these findings in different settings, recent evidence also suggests that traditional food consumption may be associated with higher dietary diversity (e.g. Boedecker et al., 2014; Penafiel et al., 2011). In addition, cultural groups around the world continue to rely on the age-old strategy of consuming wild foods to cope with short- and long-term food shortages (Bharucha and Pretty, 2010; Burlingame, 2000; Grivetti and Ogle, 2000; Huss-Ashmore and Johnston, 1994). Despite a growing consensus on the potential value of traditional dietary knowledge and the associated consumption of traditional foods, benefits or disadvantages of a wide set of traditional foods remain largely unexplored (Johns and Sthapit, 2004).

Culture further influences food choice by determining consumers' acceptance of new food technologies and innovations. The cultural drivers of food acceptance, and the impact on food choice, have been extensively investigated for industrialized countries, primarily in the context of genetically modified (GM) foods. Finucane and Holup (2005) for instance find that conservative

¹² In analogy with the definition of traditional food production we consider traditional food as food provided by the natural resources available to the group (both wild and cultivated) that has been consumed for a long period of time and reflects cultural inheritance, i.e. the production and consumption of the food is socially transmitted within the cultural group (e.g. Guerrero et al., 2009; Roche et al., 2008; Trichopoulou et al., 2007).

attitudes toward novelty in Germany, a rejection of the US fast food culture associated with GM food in France, and religious values regarding the immorality of disturbing the natural order across Europe, reduce acceptance rates of GM foods (see also Curtis et al., 2004; Ronteltap et al., 2007). Research for non-industrialized countries and other food technologies is scarce. Some recent work has explored the cultural drivers of consumer acceptance of bio-fortified maize in low-income countries (De Groot and Kimenju, 2008; Meenakshi et al., 2012; Stevens and Winter-Nelson, 2008), but the evidence base is too limited and too heterogeneous to draw any conclusions.

Finally, culture also shapes preferences about ideal body sizes (Batnitzky, 2011; Helman, 2007; Olvera et al., 2005), which may affect eating behaviour. Although globally preferences seem to be shifting to thin bodies, large bodies remain the ideal in various cultural groups (e.g. Batnitzky, 2011; Helman, 2007; Micklesfield et al., 2013). Quantitative evidence on the impact of these preferences on actual body sizes however remains limited, mixed, and likely is confounded by two-way causality since actual body size may affect body size ideals (e.g. Flynn and Fitzgibbon, 1998; Olvera et al., 2005; Swami et al., 2007).

3.3. Utilization

How we prepare food is strongly determined by culture (e.g. Fieldhouse, 1995; Kittler et al., 2011; Lawrence and Barker 2009). As Lawrence and Barker (2009:191) put it: “*memories from childhood provide images that stay throughout adulthood; thus, homemade or mother’s cooking are used as reference points for how food should be prepared and taste*”. Food preparation involves the combination of different individual foods into meals, and the way these foods are processed. Both have important implications for nutrient intake and absorption as well as the digestibility, palatability, and safety of foods (Milburn, 2004; Ruiz-Rodriguez et al., 2008; Tapsell et al., 2006).

There has been growing interest in the properties of food combinations in traditional food preparation, with various studies finding that certain combinations offer nutritional benefits. Milburn (2004) discusses the example of the dramatically higher protein quality of grains-legumes combinations (e.g. maize and beans in the Americas) compared to the sum of the separate foods due to protein complementarity.

Traditional food processing often also continues to play an important role in present-day food preparation (e.g. Benkerroum, 2013; Liu et al., 2011). Certain techniques such as fermentation, soaking, or malting have been identified as cost-effective and energy-efficient ways of improving the nutritional value, safety, palatability, or digestibility of food in diverse settings (E.g. Fandohan et al., 2005; Hotz and Gibson, 2007; Hwang and Lee, 2006; Klayraung et al., 2008; Liu et al., 2011; Makokha et al., 2002). However, as one method can affect food components in different ways,

trade-offs take place (Abuajah et al., 2014). Some techniques (e.g. prolonged heating, sun drying) may for instance improve food safety at the expense of nutritional value (Hotz and Gibson, 2007; Lyimo et al., 1991). In addition, there are substantial differences in the performance of different traditional processing methods of the same food across groups. Given the important effects of food processing, storage, and preparation on food security, researchers have called for heightened efforts to explore the benefits and risks of a wider set of traditional techniques (Allen and Gillespie 2001; Cardoso et al., 2005; Hotz and Gibson, 2007).

Box 4: Traditional cassava processing techniques

Cassava naturally contains cyanide in modest quantities. Consumption of large amounts of cassava and derived products may therefore cause cyanide poisoning, leading to symptoms such as vomiting, diarrhoea, and possibly death. In addition, cyanide intake from cassava exacerbates goitre and cretinism in iodine deficient areas, and chronic dietary exposure to cyanide has been associated with diseases such as konzo and Tropical Ataxic Neuropathy. Processing methods to reduce the cyanide content of cassava flour were developed by trial and error hundreds of years ago by indigenous peoples in Amazonia for the preparation of *farinha* (cassava flour) which involves scraping, grating and roasting of the roots. This elaborate technique has been proven very efficient in reducing cyanogen levels, and there is no evidence of cyanide toxicity associated with cassava use among indigenous peoples in Amazonia. In contrast, heap fermentation and sun drying, commonly used in eastern and southern Africa, do not adequately remove cyanide.

Source: Cardoso et al. (2005) and Dufour (1994)

3.4. Stability

Culturally transmitted dietary rules have been found to affect the efficiency and sustainability of resource use. The importance of taboos – and more generally cultural or religious beliefs – as frameworks for governing natural resource extraction is gaining widespread recognition. Taboos restricting the consumption or production of certain foods in time or space can for example support species conservation and sustainable resource exploitation and thus contribute to the stability of the food supply (Cinner, 2007; Colding and Folke, 2001; Jones et al., 2008; Meyer-Rochow, 2009). In other cases the conservation value of taboos however appears to be limited – for instance because the group upholding the taboo is too small to have any significant impact (Golden and Comaroff, 2015; Fessler and Navarrete, 2003). Moreover, negative effects can occur when culturally transmitted food prescriptions result in (local) overexploitation of the targeted species – in particular when wild species become commercially traded (Chamberlain et al., 2004).

Box 5: The conservation value of Malagasy social norms

Among central eastern Malagasy communities, strict social norms govern the timing for harvesting and hunting certain species. The ‘correct’ time for hunting tailless tenrecs (a small mammal somewhat similar to a hedgehog) is for example considered to be April or May, which is after the young have become independent (Nicoll, 2003). Despite the fact that the sanction is social disapproval rather than supernatural retribution, this taboo is strictly observed. Tenrec hunting (as opposed to killing a tenrec found during other activities) only occurs during these months. As such, this taboo contributes to the sustainable exploitation of this species.

Source: Jones et al. (2008)

In addition, traditional food crops often demonstrate higher resilience and lower care needs compared to non-indigenous cultivated foods. A number of studies also finds that traditional crop selection and pest management systems may contribute to the stability of food production, as some have been found to be particularly well adapted to local environments and shocks, for instance through the use of crop varieties that are resistant to different types of environmental stresses, have different growing periods and durations, or have different nutritional requirements (Abate et al., 2000; Altieri, 2004; Clawson, 1985). The property of higher resilience and resistance to different types of environmental stresses is particularly attractive in a context of increasing climatological risk and uncertainty.

Finally, as mentioned above, culture influences processing and storage of food, which can promote longer shelf life. This can in turn mitigate constraints such as seasonality and poorly functioning markets (Keding et al., 2013) and contribute to the stability of food consumption.

4. Gender, Family and Decision-Making Power

At the individual and household level, gender, family, and decision-making power are key crosscutting determinants that interact with most, if not all, channels through which culture affects food security.

4.1. Gender

Each society is characterized by a “*set of guidelines, both implicit and explicit, that are acquired from infancy onwards, and tell the individual how to perceive, think, feel and act as either a male or female member of that society*” (Helman, 2007: 158). These cultural gender models are of paramount importance when discussing the impact of culture on food security. First, gender can determine directly what preferences, beliefs, norms, and practices one is expected to display or observe. For instance, women often face a larger number of dietary rules due to their reproductive role (Bentley et al., 1999; Odebiyi, 1989; Meyer-Rochow, 2009). In addition, other gender-specific social norms that are not directly related to food can influence food security as well. Ravindran et al. (1986) for example point to cultural

restrictions in Haryana, India, on adolescent girls' freedom to leave their home as impediments to their physical access to significant sources of dietary diversity. Hence, one needs to be cautious in extrapolating evidence on the impact of culture from men to women and vice versa.

Second, gender will often interact with effects of culture. Gender roles within the household, notably the division of household labour, are particularly important in the context of culture and food security as they interact with many channels of impact such as dietary practices and intra-household food distribution (Batnitzky, 2011; Moss, 2002; Piperata, 2008).

Box 6: The importance of gender roles in explaining the impact of 'resguardo'

'*Resguardo*' derives from the Portuguese verb '*to protect*' (*resguardar*) and refers to a period of food and work restrictions after childbirth. Women throughout several parts of Brazil and other Latin American countries observe the practice. An analysis of dietary intakes revealed that *resguardo* women have lower energy intakes, but this reduction is not caused by food proscriptions. Rather, the belief that conducting physically demanding tasks threatens a woman's current and future health combined with gendered household labour division reduced energy availability. More specifically, *resguardo* work restrictions prevent women from performing their usual staple food processing and preparation tasks, which reduces the availability of staple foods in the household (as husbands generally do not take over).

Source: Piperata (2008)

4.2. Family

Family structures, including the different relations and responsibilities of family members, can interact with the food security effects of culture in three important ways. First, family life plays a crucial role in the development of eating habits, among others through socialization into cultural models, parental modelling, and exposure at home (Birch and Fisher, 1998; Patrick and Nicklas, 2005; Taylor et al., 2005; WHO, 2012). There is extensive evidence for an indirect long-term impact of infant and child feeding practices on food security through the development of food preferences in later life (Birch and Fisher, 1998; Taylor et al., 2005; Wardle and Cooke, 2008). For instance, serving sugar-rich foods in positive contexts (e.g. celebrations) can strengthen children's innate preference for sweet foods, which may promote overnutrition in later life (Birch and Fisher, 1998; Birch, 1999).

Second, mothers often share home care and child feeding responsibilities with other family members – in particular grandmothers – who may have a large or even primary influence in these areas. Fouts and Brookshire (2009) for instance find that among the Aka foragers in Congo, mothers contribute less to child feeding than other family members combined (e.g. fathers, grandmothers, aunts).

Third, the preferences and beliefs of recipient family members can influence the choices of caregivers (e.g. in home care, cooking, etc.) to varying degrees (Just et al., 2007; Lawrence and Barker 2009).

4.3. Decision-making power

Gender models and family relations are of course closely linked to decision-making power. The main locus of power in decision-making processes varies across cultural groups, from highly individualistic models to highly collectivist models where the locus of power lies mainly with the community (Hammoud et al., 2005; McLaughlin and Braun, 1998). Individual decision-making power within groups may depend on a variety of factors, but are commonly associated with gender, age, and social status. In many cultural groups, elders are important decision makers in the family and community, and in that function play a key role in preserving, transmitting, and changing culture traits (e.g. Aubel, 2012; Bezner Kerr et al., 2008; Fouts and Brookshire, 2009; Geçkil et al., 2009; Kaewsarn et al., 2003; Raven et al., 2007).

Decision-making power is a major mediating factor in the relation between culture and food security. Who decides when and what food to buy or produce, or how to distribute it within the household, to give a few examples, can have a crucial influence on the impact of culture traits (e.g. Denney et al., 2014; Lori and Boyle, 2011; McLaughlin and Braun, 1998; Scott et al., 2014). This also implies that who provides and who receives information matters a great deal for the impact of information interventions on behaviour.

5. Dynamic Aspects of the Culture-Food Relation and Drivers of Change

As mentioned before, culture is dynamic and evolving, often changing in response to a changing environment. Food and non-food classifications or food taboos, for instance, can change in times of food shortages (Fessler and Navarrete, 2003; Helman, 2007). However, culture can also be a powerful and emotionally held preserver of stability and predictability, strongly resisting change (Fieldhouse, 1995; Weisner, 2000). Even in situations of extreme starvation for instance, groups may hold on to food taboos (Helman, 2007). Malagasy dietary rules illustrate this duality well: whereas one type of proscriptions is perceived as negotiable and people can ask their ancestors to free them in times of need, breaking other extremely strict taboos is always expected to lead to illness or misfortune (Jones et al., 2008).

The question of when, how, and why culture changes or persists is at the centre of a growing body of theoretical and empirical research across disciplines.¹³ Existing theories continue to be debated, and a full discussion of the topic exceeds the scope of this paper. We instead highlight the question of how modernization relates to cultural change, which has received particular attention in recent years. Classic modernization theory states that traditional values, beliefs, and customs – especially religion and supernatural belief systems – will inevitably disappear with rising urbanization, education, and the spread of scientific and technological advancements (Iannaccone, 1998; Inglehart, 2016). As many have argued that this assumption does not hold invariably, scholars have sought reformulations of the classic theory. Inglehart (2016) for instance proposes an evolutionary modernization theory, in which modernization is argued to increase economic and physical security levels, which creates important cultural changes in similar directions. Yet, because culture is highly persistent, these cultural changes are path-dependent and reflect historically determined cultural differences. A case in point is the continued and possibly growing vitality of witchcraft beliefs in sub-Saharan Africa (e.g. Gershman, 2016b; Kohnert, 2007; Leistner, 2014), or the continued importance of religion outside of Europe and its offshoots (Iannaccone, 1998). The take-away message is that one can expect important cultural change following modernization processes such as income growth, but such change does not necessarily erode cultural differences or the historically shaped core characteristics of a culture.

5.1. Change and persistence in the cultural drivers of FNS

In the context of food security, we indeed see both cultural change and persistence. Research has documented cases where modernization and economic development are associated with a loss of traditional knowledge (Gómez-Baggethun et al., 2010; Gómez-Baggethun et al., 2013; Reyes-García et al., 2013) and an erosion in adherence to certain food-related culture traits (e.g. Lilette, 2006; Piperata, 2008; Englberger et al., 2003). Indigenous peoples have often experienced particularly drastic dietary changes following the modernization of food systems – although the degree to which traditional food systems disappeared varies considerably (Kuhnlein et al., 2009).

Then again, an illustration of the persistence of food habits is the fact that in many regions the dominant staple crop continues to be the crop that was endemic to that ecological zone, i.e. the crop that was eaten by pre-industrial societies (Atkins and Bowler, 2001). More generally, research documents various cases where in spite of broad societal changes including migration¹⁴

¹³ See e.g. Alesina et al., 2013; Boyd and Richerson, 2004; Gershman, 2015; Henrich and McElreath, 2003; Lee et al., 2009; Mesoudi, 2011.

¹⁴ Migration flows (e.g. the arrival of outsiders who do not adhere to the same rules) can lead to cultural erosion (e.g. Maarleveld and Dangbégnon, 1999; Kaufmann et al., 2006).

and the spread of Western religion, food-related cultural models have remained relatively intact (e.g. Golden and Comaroff, 2015b; Jones et al., 2008).

While both change and persistence have been clearly observed, the question of when and how cultural models of eating and food habits change remains highly complex and poorly understood. New information appears to be a major driver of cultural change overall, as it alters the socially transmitted information set that is culture. In particular, cultural change seems to occur when new information is linked to existing cultural models, as this facilitates acceptance and integration of the new information or the reinterpretation of pre-existing knowledge (Aubel et al., 2004; Bezner Kerr et al., 2008; Kuhnlein et al., 2013; Semega-Janneh et al., 2001).

In this light, research on the impact of migration – which entails exposure to new information and different culture traits – can offer insights into the question of how and when cultural models of eating and food habits change. Chowdhury et al. (2000) for example find that Bangladeshi migrants in the UK largely maintained their traditional dietary habits. Reviewing surveys on the food habits of migrant populations in Europe, Gilbert and Khokhar (2008) find that some immigrant populations spend significantly more on preserving their food habits than others, regardless of socio-economic status. The authors suggest that the extent of dietary acculturation may depend on the value placed on one's original food habits and those in the host country, as well as the availability and accessibility of foods from the original diet. Generation and age also appear to play an important role. Younger generations of Pakistani migrants in the UK were for example more likely to change their eating habits as British foods were seen as convenient, associated with the host country, and reflective of adventure and independence (Jamal, 1998).

5.2. Globalization, cultural change, and shifts in diets and food habits

An important recent development in this context is the large-scale global shift in human diets and food habits in similar directions (high consumption of saturated fats and sugars, highly processed foods, and out-of-home meals), a phenomenon often referred to as the '*nutrition transition*' (Chopra et al., 2002; Kearney, 2010; Keats and Wiggins, 2014; Monteiro et al., 2013; Popkin et al., 2012). However, it remains unclear to what extent this global shift in diets reflects cultural change, and to what extent it is a consequence of the globalization of food systems. These processes are of course not mutually exclusive, as food system changes can generate cultural change and vice versa. Recent studies on alcohol consumption patterns for example argue that in combination with income growth, globalization has increased access to foreign investment and new products, as well as the spread of knowledge and information on these products, ultimately giving rise to a global convergence of alcohol consumption patterns (Colen and Swinnen, 2016; Swinnen and Briski,

2017). Other studies also suggest that the globalization of food systems along with the globalization of ICT technologies and mass media spreads cultural lifestyle and eating models (e.g. fast food) (Huynen et al., 2005; Keats and Wiggins, 2014). Yet, there is little rigorous research regarding the relative importance of cultural drivers and socio-economic or supply side factors in the nutrition transition.¹⁵

5.3. Mass media, marketing, and changing cultural models

Media and marketing are a major source of information for the public and thereby both reflect and shape culture traits (Wakefield et al., 2003). Mass media is increasingly visible and accessible through ICT developments such as mobile internet connection, and marketing has expanded far beyond simple advertising into marketing environments that include sales promotions, websites, viral marketing, music and sports sponsorship, product placement in films and television, and in-school marketing (Hawkes, 2006).¹⁶

It is important to note that though advertising is now a global phenomenon (Hawkes, 2006), research on the nature and impact of media and marketing in developing countries is scarce. Available evidence from developed countries shows that media and marketing have a strong effect on food choice (Cairns et al., 2013; Cohen, 2008; Harris et al., 2009; Taylor et al., 2005). Three broad mechanisms are at play. First, marketing affects automated, uncontrollable responses through environmental cues, such as the placement of products in supermarkets (Cohen 2008). Second, the omnipresence of media and marketing in everyday life and popular culture shapes habits and preferences by creating powerful cultural models of food, health, and lifestyle that consumers are driven to emulate (Atkins and Bowler, 2001; Nestle et al., 1998; Wakefield et al., 2003). Exposure to mass media has for example been associated with internalization of a thin body ideal and changes in women's eating behaviours and beliefs (Grabe et al., 2008). Third, media affects perceptions of the risks and benefits of foods (Cairns et al., 2013; McCluskey and Swinnen, 2004; Taylor et al., 2005).¹⁷

As for the direction of impact, both positive and negative effects occur. On the one hand, the powerful influence of media and marketing can be detrimental to food security. Marketing generally induces overconsumption (Anderson et al., 2009; Cohen 2008; Lovato et al., 2011). Food marketing is also often heavily oriented toward low-nutrition, obesogenic foods and beverages and

¹⁵ Watson (2006) offers an in-depth study of the rise of McDonald's in East Asia, and argues that the success of McDonald's in Beijing is driven by associations with freedom, democracy, and 'world citizenship', rather than the taste or convenience of the food.

¹⁶ See also Kretchmer (2004) for a discussion of the increasing presence of advertising in the entertainment sector, resulting in so-called 'advertainment'.

¹⁷ This media effect seems to explain a significant part of between-country differences in GM food regulations (Vigani and Olper, 2015).

has been shown to increase the consumption of these foods (Cairns et al., 2013; Dixon et al., 2007; Harris et al., 2009; Monteiro, 2009).

Box 7: Focus on unhealthy foods in television advertising

Analysis of television advertisements on channels most popular with children in 13 countries across 5 continents revealed that in each country, food products were in the top 3 advertised products. For all countries, the majority of food advertisements (67%) were for foods that are relatively high in undesirable nutrients including fat and sodium. Programmes specifically targeting children contained an even higher proportion of advertisements for these foods (80% of food advertisements). Fast-food restaurant meals and chocolate and confectionary in particular were the most frequently advertised food products.

Source: Kelly et al. (2010)

In addition, marketing is often aggressively targeted to children and adolescents with the aim of shaping long-term food habits, and may thereby negatively affect long-run food security already from a young age (Cairns et al., 2013; Harris et al., 2009; Wakefield et al., 2003). Finally, the information transmitted by media and marketing does not necessarily conform to the best scientific knowledge and may include misleading nutrition claims, thereby contributing to misinformation about food (Abrahams et al., 2016; Keats and Wiggins, 2014; Nestle et al., 1998; Taylor et al., 2005).

On the other hand, the power of media and marketing can also be used to promote positive behavioural change (Randolph and Viswanath, 2004; Snyder, 2007; Wakefield et al., 2010). Public mass media information campaigns appear to have small but positive effects on changing eating behaviours (e.g. Matson-Koffman et al., 2005; Pomerleau et al., 2005; Snyder et al., 2004). Experiments with the use of social media and digital technologies for promoting desirable diet and health behaviour show promise, but further research is needed to draw conclusions about behavioural impact and to tackle the specific challenges of these new types of media (e.g. how to control information quality on social media) (Higgs et al., 2014; Korda and Itani, 2013; Moorhead et al., 2013).

6. Conclusions and Implications for Policy and Research

This review has shown that what we eat, as well as how and why we obtain, process, store, prepare, share, and eat food, is affected by culture in various ways. Some channels of impact, such as food taboos, have been extensively researched, while for others such as the cultural drivers of food waste the literature is still in its infancy. In many cases, available research is heavily oriented toward high-income countries. Overall, empirical evidence on the impact of cultural drivers of food security appears to be mixed and varies across different cultural groups and socio-economic settings for most channels of impact, making it difficult to draw general conclusions. For example, whereas

cultural traits that stimulate the consumption of energy-dense foods may contribute positively to food security in an environment where energy requirements are high due to intensive physical labour, these culturally transmitted eating habits can contribute to rising levels of overweight and obesity when working conditions change with economic development. Despite this, we try to formulate some conclusions and recommendations as to how policy can use existing knowledge on the impact of culture to improve food security, and identify areas for future research.

The growing recognition of the importance of culture for food security has already gained culture a more prominent place on the policy agenda. Yet, less progress has been made in terms of integrating and mainstreaming it into food security policies and interventions in practice. Perhaps the most obvious and widely recognized way in which culture should be taken into account is by ensuring the availability of foods that meet culturally determined preferences.¹⁸ However, the use of culturally inappropriate foods remains a common cause of failure of supplementary feeding programs (Allen and Gillespie, 2001). A telling example comes from Kenya, where food aid in the form of maize to pastoralists, whose traditional diet is largely based on animal source foods, was not consumed but instead processed into home brewed alcohol (Barrett, 2006). Similarly, failure to safeguard the availability of and access to culturally appropriate foods has been identified as a major driver of poor food security outcomes of indigenous peoples (Kuhnlein et al., 2006a; UN, 2009).

The effectiveness of behavioural change communication campaigns is particularly dependent on how culture is taken into account as well (Kreuter and Haughton, 2006; Winham, 2009). First, the impact of information on behaviour will strongly depend on who provides and who receives information. The fact that information interventions are usually targeted at mothers and young reproductive women, thus bypassing existing gender, family, and power relations, may explain why many have not led to sustained behavioural change (Allen and Gillespie, 2001; Bezner Kerr et al., 2008; Cornwall, 2003). An improved understanding of cultural models of gender, family, and decision-making power is therefore crucial to make sure that the most relevant decision-makers or persons of influence are involved. There is growing evidence that the inclusion of family and community members and other peers has positive effects (e.g. Kuhnlein et al., 2013; Pérez-Escamilla et al., 2008; Semega-Janneh et al., 2001).¹⁹ Aubel et al. (2004) provide an illustrative example of an intervention that specifically aimed to test the impact of involvement of grandmothers in providing nutrition and health information to pregnant mothers in Senegal. The

¹⁸ The condition of meeting food preferences was for example added to the FAO (1996) definition of food security because of concerns related to the cultural acceptability of foods in different contexts (Pinstrup-Andersen, 2009).

¹⁹ See McLean et al. (2003) for interventions where the impact remains largely unclear. The impact of involving husbands in reproductive and maternal-child health interventions is more mixed (Kraft et al., 2014; Midhet and Becker, 2010; Mullany et al., 2007; Sternberg and Hubley, 2004), possibly because husbands are not always the most relevant decision-makers in this area in the study populations.

results showed sustained positive behavioural changes among grandmothers (e.g. different advice) and mothers (e.g. increased food intake during pregnancy, improved breastfeeding, and complementary feeding practices) only when grandmothers were involved, affirming their key role in turning new health information into new practice.

Second, information that is culturally appropriate and builds upon certain culture traits may be more effective in capturing attention, stimulating information processing, and ultimately motivating behavioural change. Allen and Baines (2002) for example report evidence from an experiment that suggests that individuals can be persuaded to alter their diets by stressing certain values symbolised by a food product rather than focusing exclusively on nutritional arguments. Kuhnlein (2004) also argues that interventions may be more successful when they focus on stimulating the use of health-promoting traditional foods and dietary practices. The promotion and reintroduction of traditional foods may therefore also be a useful component of strategies to tackle the double burden of malnutrition in high-income settings (Johns and Sthapit, 2004). Such strategies are of particular interest in light of recent trends of reviving local traditional or artisanal food cultures, which is argued to constitute a counter-reaction to the spread of fast food and highly processed foods associated with the nutrition transition (Pieniak et al., 2009; Wilk, 2006).

Besides cultural acceptability, certain traditional foods have also been documented to offer one or several of the following benefits: high levels of micronutrients, (natural) availability, affordability, higher resilience, and lower care needs. As such, when developing food-based strategies, it is worthwhile to explore traditional diets and gather information on the nutrition, anti-nutritional, and toxic content of traditional foods. This approach should take into account the impact of food production, processing, and preparation techniques and (in)organic contamination, in order to identify and promote the use of traditional foods that can contribute to food security. The possible economic, social, and ecological implications of these interventions should be investigated as well, since they can be highly heterogeneous across communities depending on the dietary, cultural, or economic value of the food (Kuhnlein et al., 2013; Termote et al., 2011).

Improving the integration of culture may enhance the effectiveness of production-oriented policies and interventions as well. There is growing recognition of the potential value of culture and the embedded knowledge for realizing sustainable, accessible, and qualitative food production systems. In some cases, traditional knowledge can offer a useful repository of alternative technologies that are particularly compatible with local food systems and cultural models, accessible, familiar, easy to use, and low-cost. Certain agro-ecological farming (Altieri, 2004; Pangaribowo et al., 2013) and climate change coping strategies (Stigter et al., 2005) were for example modelled after successful traditional agricultural systems. Similarly, especially when other

food technologies such as fridges or pasteurization are inaccessible or inappropriate for local conditions, traditional food processing and storage techniques can serve as inspiration. For instance, in eastern Africa where access to electricity remains limited, traditional pots of unbaked clay were found to act as an efficient replacement for a refrigerator to store milk, due to the cooling effect of evaporation (Roesel et al., 2015). Based on research and experimentation, such techniques can be further transformed in collaboration with local producers and consumers to improve the productivity and resilience of food production and the safety, efficiency, and effectiveness of food processing, storage, and preparation (Abate et al., 2000; Hotz and Gibson, 2007). A successful example of this strategy is the improvement of a traditional cassava processing method into the so-called wetting method, which rapidly reduces the cyanide content of cassava flour, in addition to improving taste and storage possibilities (Bradbury, 2006; Bradbury and Denton, 2010; Cumbana et al., 2007). Being simple and based on traditional techniques, the method has shown promise in terms of acceptance rates and positive food security effects (Banea et al., 2012; 2013). If policy is to take advantage of the potential benefits of traditional food systems, however, more efforts are needed to document and preserve these food systems and the underlying biological and cultural resources.²⁰

Participatory approaches based on dialogue and information sharing rather than top-down, directive, and expert-led interventions, may be especially suitable to take culture into account in practice.²¹ Such approaches are more likely to result multifaceted strategies that consider a broad range of cultural variables and the inclusion of local knowledge. This in turn facilitates the tailoring of interventions to local contexts and the acceptance and integration of new information in existing cultural models (e.g. Kuhnlein et al., 2013; Semega-Janneh et al., 2001). In the area of agricultural development, the possible advantages of these approaches are well established (e.g. Abate et al., 2000; Bezner Kerr et al., 2007). For other drivers of food security considered in this review, they are still less common, though some existing interventions have produced encouraging results (e.g. Aubel et al., 2004; Kuhnlein et al., 2013).

One could draw useful lessons from the health sector on how to take culture better into account in the area of food security. The practice of giving cultural training to health care providers enabling them to deliver care in a way that is intelligible and acceptable (e.g. Betancourt et al., 2003; Spector, 2002) can serve as inspiration to improve the cultural competence of those involved in the delivery of various food security interventions. Another strategy employed in health care

²⁰ In many cases these bio-cultural resources are disappearing at a fast rate (Burlingame and Dernini, 2012). Kuhnlein et al. (2006b; 2009) provide a detailed description of a protocol for documenting traditional food systems of indigenous peoples, and apply this to various indigenous peoples worldwide.

²¹ See Cornwall (2003) for a critique on the current use of participatory approaches to development.

consists of adjusting logistics to ease cultural barriers in accessing health services. Delivering perinatal care at home or facilitating accompanied travel to medical facilities for example eases constraints presented by gender norms on mobility (Mumtaz and Salway, 2005). The same could hold for delivery of food assistance or nutrition information.

There has also been a rising interest for a better integration of traditional and biomedical health services in health research and policy (e.g. Homsy et al., 2004; WHO, 2013; Zhang et al., 2011). The fact that traditional and biomedical health services are founded on different (possibly conflicting) illness and health models does not necessarily pose a problem: patients and providers are found and stimulated to make different models compatible by reinterpreting biomedical information and practices through the lens of local models, or by adapting beliefs and practices so as to make them consistent with newly acquired information (Adams et al., 2005; Obermeyer, 2000; Scott et al., 2014; Wiley, 2002). Research on the feasibility and desirability of an institutionalized integration of traditional and biomedical health services has identified the different advantages, risks, and potential obstacles (King, 2000; Mills et al., 2006). A better integration of beneficial traditional foods and traditional production, processing, and cooking methods into food systems likely faces many similar benefits, risks, and obstacles. In addition, government programs to foster health care integration that are currently being implemented in various countries (e.g. Aissan et al., 2013; Kayombo et al., 2007) may offer important insights for the design and implementation of similar interventions in the area of food security.

Finally, there are several areas for future research. A major gap in our understanding remains *how important* cultural effects are relative to other drivers, such as socio-economic (prices, income, education) or environmental factors (food availability, remoteness). A small body of qualitative and quantitative work has tried to shed light on the relative importance of cultural drivers in the context of food security. In some cases cultural variables are argued to trump economic or environmental determinants (Atkin, 2016; Choudhury and Ahmed, 2011; Watson, 2006), while in other cases culture seems to play a secondary role (e.g. Goldman et al., 2002; Hartini et al., 2005).

One possible reason for the paucity of systematic research analyzing and comparing cultural, economic, and environmental effects on food security is the qualitative or descriptive nature of a large part of the literature, with limited information on the size of cultural effects. A first step toward an improved understanding of the relative importance of culture thus lies in the quantification of its impact on different aspects of food security. Both on the consumption side and the production side, however, major data gaps remain. For instance, in contrast to a large literature on the role of culture in health gaps for marginalized groups (e.g. Helman, 2007; Smedley

et al., 2002), little is known regarding food security gaps. To understand the extent to which cultural factors contribute to poor food security of severely marginalized groups such as indigenous peoples there is an urgent need for systematic and comprehensive data collection on both cultural drivers of food security and needs and outcomes for marginalized groups (Stephens et al., 2006).

A second vital question that remains poorly understood relates to the dynamics of culture. Although notable progress has been made in various disciplines toward understanding the origins and evolution of culture, the question of when, how, and why culture changes or persists remains a highly complex one that is intertwined with environmental, social, economic, and politico-institutional change. For instance, while both change and persistence have been clearly observed, we understand little of when and how cultural models of eating and food habits change. In this context, the rapid growth and spread of new information and communication technologies (ICT) is of particular interest. Recent research suggests that new global marketing campaigns, the rise of social media, and the rapid spread of mobile phones in developing countries can affect food preferences and dietary knowledge (e.g. Abrahams et al., 2016; Dixon et al., 2007; Rutsaert et al., 2013). Since ICT technologies can be expected to develop and spread further, more research is needed to improve our understanding of their potential effects and the implications for food security policy. For instance, future research could explore how to curb any negative food security effects and how ICT technologies can be usefully incorporated in food security strategies.

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