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Do Evolutionary Perspectives of Morning Sickness and Meat Aversions Apply to Large-Scale Societies? An Examination of Medieval Christian Women

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by

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The Thesis of Kristen M. Snodgrass is approved and it is acceptable in quality and form for publication on microfilm and electronically:

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DEDICATION

To my best friends Holland and Crystal and my cousin Lori, who never fail to turn darkness into light.

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ABSTRACT OF THE THESIS

Do Evolutionary Perspectives of Morning Sickness and Meat Aversions Apply to Large-Scale Societies? An Examination of Medieval Christian Women

by

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Master of Arts in Anthropology

University of California, San Diego, 2012

Professor Margaret Schoeninger, Chair

A hypothesis put forth in 2002 by Daniel Fessler argues that, of all food types, meat and animal products are the most likely food items to carry pathogens and are, therefore, the principle target of gestational food aversions and pregnancy food taboos. Fessler posits these aversions are likely a source of selective pressure that has affected pregnant females throughout human history. Through an examination of 73 societies, Fessler's findings support his hypothesis. These societies, however, are small in scale.

This thesis examines the validity of Fessler's (2002) hypothesis in large-scale societies comprising medieval Christian Europe. The reasons for choosing the medieval period are threefold. First, there is a lack of large-scale societies in the populations Fessler investigated. Second, if meat aversion is an evolutionary adaptation that has continued to be selected for, then it should apply to pregnant medieval women. Third, if meat aversions are selected to protect the mother and embryo from pathogen ingestion, then choosing large-scale societies with access to various forms of meat, but lacking in modern sanitation practices, should bring to light the applicability of this hypothesis to large-scale societies.

Through an investigation of staple diets, religious dietary views, medical literature, and wives' tales of medieval Christian women, aversions to animal flesh and animal products among pregnant women do not appear to be supported. I propose, therefore, that Fessler's hypothesis should be rejected, since it is based almost exclusively upon biological constraints within small societies, and does not take cultural constraints of large societies into consideration.

INTRODUCTION

Food can be viewed in two different lights. Biologically, food is a necessity. The make-up of different food items provides the consumer with nutrients that fuel the body in maintaining basic homeostasis, which is the physiologic regulation of the inner environment to allow for stability in response to the outside environment. Food also provides the consumer with the required energy needed in performing everyday tasks. Food, however, can also be viewed as a cultural marker. Though food items not available in a particular environment cannot be eaten, it is also true that not all available food items are consumed (Grivetti 1978: 171). Early studies indicate that culture was the sole influence that determined what was appropriate to eat. One such cultural hypothesis, put forth by Mary Douglas in Purity and Danger (1996), argues that the concept of pollution is a means through which people could process animals, people, actions and events that did not fit within their cosmology. This served to avoid ambiguity and more importantly, the painful cognitive dissonance that attends such unresolved codes (Laderman 1981: 468). Once researchers demonstrated that there was an unavoidable disconnect between socially sanctioned food and nutritionally sound diet, they soon hypothesized that forces other than culture contribute to both dietary repertoire and food taboos.

The fact that avoided and/or restricted food items may be efficient forms of nutrients, protein, and/or fat is a paradox. This is particularly true when examining people of lower class to those of the upper in large-scale societies or hunter-gather cultures. It seems unlikely that these two groups would have the option to be selective in regard to the source of their nutritional requirements. Despite this, numerous studies have shown that individuals, including those in low economic standing and hunting and gathering populations, display aversions to specific food items and/or adhere to institutionalized food taboos (e.g., Fessler and Navarrete [2003]),

Most surprising, however, is that the majority of avoided and tabooed food is meat and other animal products, which is astonishing for multiple reasons (see Table 1). First, it is known that meat was an important component in the diets of human ancestors (Rose 2001: 141, Ross 1987: 11). Additionally, meat and animal products are efficient sources of protein and fat. Finally, as stated in Stanford (1999), this dietary category is ranked as a highly valued food item by a majority of the world's cultures. With these factors in mind, it seems remarkable that any culture would prohibit consumption of dietary items found within this food category. While most individuals within cultures that subscribe to proscriptions regarding meat and other animal products are affected, none are more so than pregnant women. This is particularly perplexing because expectant women need more calories and protein to support themselves, as well as the growth of their developing

embryo. Why then would these highly regarded, important, and efficient sources of nutrients be rejected?

Fessler (2002) addresses the specific issue of such taboos for women during pregnancy. He argues that compared to all other food types, meat and other animal products are the most likely to carry pathogens, and are, therefore, the principle target of gestational food aversions and pregnancy taboos. Such pathogens are a likely source of selective pressure, which has affected pregnant females throughout human history. One proximate mechanism could be gestational cravings, many of which are geared toward

> substances that may influence immune functioning and affect the availability of iron in the gastrointestinal tract, therefore limiting the proliferation of iron-dependent pathogens. (Fessler 2002: 19)

Another is morning sickness, which differs strikingly from normal nausea and vomiting.

Several claims have been made that pregnancy sickness, like normal nausea and vomiting, is a functional adaptation. The greater sensitivity on the part of the pregnant woman is thought to be a means of compensating for the vulnerability of the embryo and/or fetus. Building upon this, Fessler (2002) argues that if pregnancy sickness is an adaptation, natural selection will have imbued it with discriminatory specificity. In other words, in order to prevent the costly avoidance of beneficial food items in the diet, only food items that pose a significant and recurrent threat should acquire nauseogenic salience during pregnancy. According to this argument, pregnancy taboos may reflect

evolutionary adaptations that were selected to protect both mother and embryo, and probably represent the moralization of a prevailing pattern, an institutionalized understanding of a casual relationship and/or a self-serving institution created for the benefit of those in power. He tested his argument using 73 societies showing a good fit between expectation – the avoidance of meat and animal products consumption among pregnant women – and observation. Even so, all 73 populations were small-scale societies. It is unclear whether or not large-scale societies would show the same pattern, particularly since aspects of large-scale societies, such as more hygienic food preparation and storage, would mediate the dangers of pathogen ingestion during pregnancy.

This thesis examines whether Fessler's framework extends to larger scale societies, specifically those of medieval Christian Europe. I also consider some of the criticisms of Fessler's hypothesis. First, I will discuss food taboos and their psychosocial constructs to examine how food aversions develop into institutionalized taboos with the emphasis on those directed toward animal products. This is followed by an assessment of the intrinsic dangers meat and animal products pose to consumers, focusing on the potential of pathogen and/or toxin transmission. The subsequent two sections examine meat aversions in both human and nonhuman animals. This is to explain Fessler's evolutionary adaptation argument and examine the merits of his claim. How aversions toward the meat and products of specific animals have developed

will also be discussed with a focus on how institutionalized food taboos regarding specific animals may have come about. Next is a discussion of morning sickness as an evolutionary adaptation and why nausea and vomiting in pregnancy, as well as aversions towards meat and animal products serve to protect both the pregnant woman and her embryo. Finally, medieval Christian women, their staple diet, and the foods they consumed during their pregnancies will be examined.

1 Animal and Animal Product Taboos

Food taboos often describe foodstuffs that are available for consumption, but are rejected as dietary components. Abstaining from particular food items may be due to religious, cultural, or hygienic purposes, or any combination of the above. Regardless of the rationale, food proscriptions often reveal how specific cultures experience their world (Meens 2995: 5, Super 2002: 171). For example, some cultures believe that the ingestion of a particular food item results in the consumer taking on the attributes associated with it (Woolgar 2010: 8). If the food item is thought to have negative qualities, it would be important to separate oneself from its consumption. Additionally, taboos of certain foodstuffs may serve to distinguish one culture from another. This can be seen in the Jewish proscription of pork. While some scholars hold that his taboo was established to protect against trichinosis, others argue that this cannot be the sole reason because two non-Jewish cultures also occupying the Levant, the Philistines and Canaanites, consumed pig (Faust 2008, Bunimovitz and Lederman 20090). Whatever the justifications for dietary proscriptions may be, it is clear that conceptions regarding food and its qualities of edibility or contamination can vary greatly across cultural groups.

This is not always the case, however, as parallel sentiments can be held by different cultures. One example of this occurrence is the avoidance and/or taboo of meat and other animal products, which Fessler (2002) argues

is a panhuman adaptive mechanism that protects against pathogenic infection. This marked occurrence has typically been attributed to functional and symbolic schemas. Fessler and Navarrete (2003), however, are dissatisfied with these approaches, which do not produce a convincing explanation as to why meat is a particular target of food taboos. These authors argue that meat, despite its nutritional quality and value as an efficient source of protein, is potentially dangerous, as it is the food source most likely to contain pathogens. Therefore, Fessler and Navarrete (2003) propose that natural selection has brought about ambivalence toward meat that makes this particular food type the target of repulsion and dietary taboo. This ambivalence is incorporated into the social system through socially mediated ingestive conditioning, egocentric empathy, and normative moralization (Fessler and Navarrete, 2003).

1.1 The Dangers of Meat Consumption

One claim is that animal and animal products are particularly unique in terms of threats. They are hosts to a myriad of bacteria and other forms of pathogens (see Table 2). Tissues of different animals may harbor similar pathogen threats. Additionally, the immune system dies along with an animal, so the pathogens proliferate that may have been present in the animal at the time of death or in its surrounding environment. This is not to say that meat is the only source of toxins in the environment. There are many plant species

that pose threats to consumers, but their hazardous properties are typically highly detectable and predictable. This is not accidental, but a preventative measure on the part of the plants. These distinctive defenses may be mechanical, such as thorns, thick outer layers, or camouflage. Natural selection has also allowed for toxic flora to exert unambiguous chemical indicators to prevent potential predators. This may include the emission of offensive odors or produce foul tastes (Lambert 1998: 9, Profet 1992: 328-331). Pathogens, on the other hand, are either neutral or favor crypsis in regard to transmission (Fessler and Navarrete 2003: 20). Furthermore, these disease-causing microorganisms do not produce detectible odors. Therefore, consumers are not always forewarned of potentially dangerous meat based on aroma. Finally, although cooking greatly reduces the risk of pathogen transmission, it is not always the case that meat is cooked thoroughly or hands and/or cooking utensils sufficiently cleaned prior to food preparation (Fessler 2003: 26). Fessler and Navarrete (2003) argue that these sanitary practices and careful attention to thorough cooking were unlikely to have been observed with any constancy before the negative consequences of undercooking and unsanitary conditions were known. These authors surmise that cooking would not have eradicated the possibility of pathogen transmission.

Fessler and Navarrete (2003) go on to conclude that evolved psychological mechanisms, or emotions, have produced and shaped cultural traditions of food taboo. More specifically, it is

> because all humans possess evolved psychological mechanisms that predispose them to view meat as potentially disgusting, taboos and avoidance practices that focus on animals are not only more likely to arise, they are also more likely to be maintained and to diffuse (Fessler and Navarrete 2003: 24-25).

1.2 Meat Avoidance in Humans

Like nonhuman animals, humans, particularly those from Western cultures, are more likely to reject foreign meat and animal products than other unfamiliar food items (Pilner and Pelchant, 1991). Martins et al. (1997) claim that people can be persuaded to eat novel foods, but not if it is meat. They base this on a study conducted focusing on college students' willingness to taste novel foods. Each student was told one of four descriptions regarding the foreign food item: nothing, it tasted good, it had a high vitamin content, or it was high in vitamins and might soon be available in the cafeteria (Martins et al. 1997: 93). Students were more inclined to taste the novel food when told it tasted good and had high vitamin content. Willingness to taste novel foods of animal origin, however, was not affected by any of the descriptions listed above, but by a measure of trait neophobia. Martins et al. (1997) conclude that emotional responses to animal and animal products may hinder information effects.

Fessler and Navarrete (2003) cite studies that support this claim. Mattes (1991) and Rodin and Radke-Sharpe (1991) found that in North America, meat aversions comprise more than one-third of food avoidances. According to these authors, aversion to animal and animal products are triple

the magnitude of any other category (see Table 3). A study conducted in 1985 by Midkiff and Bernstein show similar results. Meat and other animal products are considerably over-represented when compared to the salience of different food types and their frequency as a component in the subjects' diets (Midkiff and Bernstein 1985: 840). Midkiff and Bernstein (1985) interpret the conditioned aversion to be based on the taste and/or post-ingestive properties of this food. Burge et al. (1995) agrees that meat and animal products elicit nausea or vomiting and are, therefore, avoided. In a medical procedure these authors found that gastric bypass patients avoid animal and animal products more than any other type of food (Burge et al. 1995: 668). Additionally, individuals undergoing chemotherapy treatment display conditioned aversions to meat (Boakes et al. 1993). Fifty percent of the 98 patients studied reported a change in diet in which the most common development was meat aversion (Boakes et al. 1993: 868).

1.3 Meat Avoidance in Nonhuman Animals

Fessler and Navarrete (2003) support their claims about the psychosocial process of ingestive conditioning using an analysis of investigations of meat aversion in nonhuman animals. A study conducted by Aggleton and Passingham (1981) demonstrates that rhesus macaques that are deprived of protein exhibit increased consumption of otherwise unpalatable foodstuffs. Despite this, the incorporation of meat in the diet is still

lower when compared to other dietary components (Fessler and Navarrete 2003: 20).

Similar results were obtained by Bernstein et al's (1984) study of lab rats and Bradshaw et al's (2000) examination of domestic cat meat consumption rates. Lab rats developed conditioned disgust to high protein food items at higher rates when compared to high carbohydrate foodstuffs. Domestic cats, though carnivorous creatures, demonstrate decreased meat consumption and neophobia toward raw meat when the amygdala is stimulated.

2 Psychosocial Explanations for Animal and Animal Product Taboos

Whatever the justifications for dietary proscriptions and/or avoidance may be, it is clear that conceptions regarding food and its qualities of edibility or contamination vary greatly across cultural groups. Perhaps when such parallel sentiments are held by different cultures, the reasons extend beyond the functional and symbolic to include psychological processes (Fessler and Navarrete 2003). These authors identify three mechanisms by which psychosocial processes, such as personal disgust responses and conditioned food aversions are transposed into institutionalized food taboos. These mechanisms are: socially mediated ingestive conditioning, egocentric empathy, and normative moralization.

2.1 Socially Mediated Ingestive Conditioning

Socially mediated ingestive conditioning, or the vicarious acquisition of food aversions (Fessler and Navarrete 2003: 16) requires derived information and/or training regarding edibility of particular foods. Dietary flexibility and omnivory are diagnostic of the Primate Order, and humans have taken it to the greatest limits. Such an adaptation puts the consumer at risk due to exposure to a wide range of toxins and/or pathogens that can be found in both plants and animals. This poses the question, how do humans know what is toxic and what is not? Flexible behavioral and cognitive abilities (Blasi and Bjorklund

2003: 262), aided by the transmissions of social information via language (Fessler and Navarrete, 2003) provide partial answers even though the transmission of social information is not a behavior exclusive to humans. In fact, occurrences have been observed in other omnivorous creatures including olive baboons (Strum 1983) and capuchin monkeys (Visaberghi, 1999). For example, although baboons and capuchin monkeys frequently hunt, most do not scavenge. Any carcass encountered typically goes uneaten. Furthermore, according to Strum (1983), olive baboons are not hesitant to eat foreign vegetable food items, but rely heavily upon social cues before unfamiliar prey is consumed. Such widespread food avoidances may be considered precursors to culturally incorporated food taboos.

2.2 Normative Moralization

Normative moralization refers to patterned behavior among members of a group. These are commonly impregnated with morality. This commonality may be explained in terms of benefits received by members of a group that adhere to them when complex human cooperation depends on conforming to and maintaining shared standards of behavior (Fessler 1999). This form of cooperation can only happen if people who violate the dominant patterns of behavior are shunned or punished in some other way for their nonconformity. Such features of cooperation led Fessler and Navarrete (2003) to argue for the psychosocial of normative moralization as a precursor to the institutionalization

of food taboos. All humans are prone to comply with socially standardized and accepted sets of behavior that are imbued with normative moralization. Therefore, a more adequate explanation for seemingly extemporaneous patterns of food aversion frequently traces back to more remote psychosocial processes, which surprisingly are potent forces of change [in establishing dietary taboos].

2.3 Egocentric Empathy

Fessler and Navarrete (2003) define egocentric empathy as an individual's experience of others' behavior as if it were their own

> ignoring others' subjective states, relying on their own dispositions instead (p. 15).

Particularly marked is the association of this process with the emotions of fear and disgust, as it alerts the consumer to the possibility of danger. Fessler and Navarrete (2003) state that in ancestral environments, individuals that placed themselves in harms way compromised the safety of those around them. Therefore, the ability to

> egocentrically empathetically experience

revulsion and aversion would have been advantageous (Fessler and Navarrete 2003: 16). For example, individuals could dissociate themselves from those participating in potentially dangerous behavior or prevent potentially dangerous behavior from occurring. Fessler and Navarrete (2003) speculate that if egocentric empathy is panhuman, then dietary taboo is

established when a population experiences the same negative response to a specific behavior. Egocentric empathy contributes to the formation of food taboos, when individuals prevent others from consuming foodstuffs that causes distress.

Fessler and Navarrete (2003) are dissatisfied with the prevailing functionalist and symbolic explanations. These approaches are particularly problematic, as neither explanation ascertains why individuals link specific emotions with food taboos (Fessler and Navarrete 2003: 18). Therefore, an evolutionary approach helps to determine the relationship between visceral feelings of revulsion and the prominence of meat in food taboos.

3 Evolved Aversions Toward Meat and the Institutionalization of Formal Taboos

The avoidance of meat and animal products is a paradox. Most food aversions are focused on this food category, but it is known that meat and animal products have been and remain important dietary components. How then do institutionalized meat and animal product taboos form at the population level? Humans possess psychological mechanisms that amplify the salience of meat as a central dietary aversion. How then do the processes of taboo formulation rationalize the institutionalization of meat and other animal product taboos? Fessler and Navarrete (2003) believe that normative moralization likely plays a pivotal role in the formulation of most taboos, but does not fully explain the avoidance of the consumption of specific fauna. Despite the existence of mechanisms that prompt an innate and instinctive feeling of circumspection and/or antipathy as a dietary component in humans, meat is extremely important. In fact, Cordain et al. (2000) and Man (2000) claim that all accessible data, particularly paleoanthropological and morphological evidence, reveals that prior to the development of agriculture, meat was a vital component in the diet of all ancestral human species. These authors state that, while the advent of agriculture lessened the importance of meat in the diet, it did not eradicate its consumption.

This can be seen through the meat/animal product paradox. Although most food aversions are focused on meat and animal products, humans are

also drawn to the consumption of these foodstuffs. Fessler and Navarrete (2003), therefore believe that, while an individual may avoid eating a particular faunal species resulting from personal experience and/or conditioned responses, it is probably not the case that an entire population would automatically avoid the same animal. These authors conclude that normative moralization is not likely to have been the initial step in the institutionalization of food taboos concerning specific animal taboos.

Fessler and Navarrete (2003) do not believe that egocentric empathy, standing on its own, accounts for specific animal taboos. These authors make this claim based on the observation that humans are both repulsed by and attracted to meat consumption. Like normative moralization, few instances of pathogen transmission would not elicit a need to taboo a particular dietary item (Fessler and Navarrete 2003: 22). Therefore, there is no reason to suppose that a significant portion of a group would have a common negative reaction when viewing individuals consuming meat or animal products.

Unlike normative moralization and egocentric empathy, Fessler and Navarrete (2003) identify socially mediated ingestive conditioning as the psychosocial process that most likely contributed to the formation of meat taboos. These authors support this argument by claiming that individuals who experience the ill effects of pathogen transmission from meat and/or animal products, or witnesses to the occurrence allows for a common inclination to develop associations of sickness with the food item (Fessler and Navarrete

2003: 23). With the onset and development of an avoidance pattern, normative moralization may induce members of a society to institutionalize the avoidance. Egocentric empathy may also come into play as a preventative measure put in place to keep others from putting themselves at risk. The important factor to note here is that socially mediated ingestive conditioning occurs first and is followed by normative moralization and egocentric empathy.

As discussed, meat and other animal products have particular salience in regards to consumption avoidance and institutionalized food taboos. Fessler and Navarrete (2003) argue that the psychosocial processes of normative moralization, egocentric empathy, and socially mediated ingestive conditioning have allowed for formal, socially accepted dietary rules to develop and spread. These taboos, however, are justifications for a strictly biological issue. Meat and other animal products are more likely to carry and transmit pathogens to consumers when compared to any other category of food (Fessler 2002: 19). While all members of a society can feel ill effects of ingesting meat and/or animal products that are either putrid or not prepared thoroughly, Fessler (2002) argues that these sentiments are especially marked among pregnant women.

4 Morning Sickness as an Evolutionary Selective Adaptation

Morning sickness may be an evolutionary adaptation selected to protect both mother and fetus by inducing vomiting and/or feelings of revulsion towards food that contain teratogenic and abortifacient chemicals (Flaxman and Sherman 2000: 113). The greatest aversions are centered on meats, poultry, fish and eggs, but also include strong-tasting vegetables, and both caffeinated and alcoholic beverages (see Table 4). Meat and other animal products often carry and/or transmit pathogens or parasites (Sherman and Flaxman 2002: S191). This is particularly true if meat and/or animal products are stored at room temperatures in warm climates. Flaxman and Sherman (2000) and Fessler (2002) maintain an evolutionary argument for morning sickness causing pregnant women to avoid food that could be potential harmful to themselves or their embryo.

Dilorio et al. (1992) and Whitehead et al. (1992) argue that morning sickness is a misleading term, as symptoms may manifest and persist throughout the day. Nesse and Williams (1994) state that the term sickness is also deceptive. Healthy women who experience pregnancy induced nausea and/or vomiting produce healthy babies. As a result, Flaxman and Sherman (2000) prefer the term nausea and vomiting in pregnancy (NPV). NVP is defined as nausea or vomiting that is common during the first trimester of pregnancy. Nausea and vomiting in pregnancy is characterized by a disruption

in appetite and/or a change in reactions to particular foods, but is not typically linked with a disruption in nutrition. Neural processes cause nausea and vomiting in pregnancy. Symptoms are triggered by outside stimuli, but the reactions occur internally at the postrema and the gastrointestinal afferents (Profet 1992: 338, Flaxman and Sherman 2000: 75). These pathways are the means through which the body responds to ingested toxins. Furthermore, the area postrema also functions for both conditioned taste aversions and controls involved in food intake. While hormonal changes that mediate NVP take place during the entire course of gestation, particularly in the first trimester, there are no corresponding variations in hormones, such as estrogens, androgens, progestagens, and cortisol in women who do not experience nausea and vomiting in pregnancy (Flaxman and Sherman 2000: 114). The conclusion reached, therefore, is that NVP is not due to personal tastes and preferences, but is a result of hormonal changes that indirectly activate neural pathways.

Hook (1980) and Profet (1995) also stress the advantage of nausea and vomiting in pregnancy.

> The expulsion of dangerous foodborne chemicals and the subsequent avoidance of these toxins via learned aversions that trigger illness

is the foundation of the embryo protection hypotheses (Flaxman and Sherman 2000: 115). Profet (1992) argues that if a pregnant woman develops food aversions, the predicted avoidances would include the following: bitter and/or pungent foods that signify high concentrations of toxins, foods with fried and/or

burnt odors suggesting the presence of mutagens, and foods with odors indicating spoilage.

Using Profet's (1992) predictions as the basis of their study, Flaxman and Sherman (2000, 2002) couple this with anthropological, medical, and psychological literature to test five predictions regarding the validity of the embryo protection hypothesis. They argue that if nausea and vomiting in pregnancy is an evolutionary adaptation, then the following five factors must be found to be true. First, positive pregnancy outcomes must be associated with women that experienced nausea and vomiting. Second, NVP should be centered upon foods that contain teratogens, mutagens, and abortifacients. Additionally, nausea and vomiting in pregnancy must be more frequent when the embryo is more vulnerable to ingested toxins and/or pathogens. In other words, NVP should be more common in the first trimester. Fourth, the onset of pregnancy related dietary aversions regarding food items that contain potentially dangerous chemicals should manifest when embryonic development is most susceptible to disruption from ingested toxins/pathogens. Finally, the frequency of nausea and vomiting in pregnancy should correspond to the diet of a population. Specifically, NVP rates should be lower when staple foods seldom contain toxins and/or pathogens that would be harmful to the embryo (Flaxman and Sherman 2000: 116, Sherman and Flaxman 2002: S192) (see Table 4).

An analysis of 56 studies by Flaxman and Sherman (2000) examining nausea and vomiting in pregnancy rates among women from 16 countries, a total of 79,146 pregnancies, NVP demonstrates positive effects for both pregnant women and their embryos (see Table 5). Every study showed that women who experienced nausea and vomiting in pregnancy were significantly less likely to miscarry than those who did not. NVP, however, did not prevent occurrences of stillbirths, preterm birth, neonatal survival, or congenital anomalies (Flaxman and Sherman 2000: 122-124). Furthermore, pregnancy induced food aversions were new developments towards particular foods, focused on meat, fish, poultry and eggs, and had the highest rates in the early stages of pregnancy (Sherman and Flaxman 2002: S192). Unlike Fessler (2002), Flaxman and Sherman incorporated study subjects that came from large-scale societies. Although their results suggest that morning sickness and meat/animal product aversion is an evolutionary adaptation, the problem with their conclusions are twofold. First, the rates for positive pregnancy outcomes and food aversions in both large and small-scale societies are combined. Therefore, it is possible their results are biased. Second, Flaxman and Sherman's analysis of staple diet and presence of NVP do not agree with their fifth prediction (see Table 6). Of the 27 cultures listed, seven (26%) have non-meat staples, but report the presence of nausea and vomiting during pregnancy. Additionally, NVP is not reported for one culture in which meat is a staple dietary component.

It is unfortunate that these types of statistics are not available for food aversions, nausea and vomiting in pregnancy, and positive pregnancy outcomes in medieval Christian women, but an examination of their staple diet and medical literature regarding what food items should be consumed and avoided may shed light on what outcome would result from an analysis of a purely large-scale society sample.

5 Medieval Perceptions of Food

Many facets of medieval Christian cultural practices and social norms regulated dietary components and dietary taboos. For example, food laws were largely instituted, influenced, and enforced by religious dictums of church and monastery (Grumett and Muers 2010: 22). This was largely centered upon theories of dietary components that expressed piety (self-restraint and/or fasting) or sin (gluttony). Food and beverage consumption was also monitored in towns by civil statutes (Cosman 1995: 37). Certain foodstuffs were only consumed for medicinal purposes (Scully 1995: 6). Philosophical edicts were also taken into account regarding moderation and restraint (Grumett and Muers 2010: 22). Economic circumstances of feast or famine dictated what individuals could afford, as did social status (Cosman 1995: 37, Woolgar 2010: 8).

Foods were also linked to the personality, character, emotional and/or intellectual states, spiritual conditions, and the morality of the consumer (Super 2002: 169, Woolgar 2010: 8, 10). In essence, people were what they ate. This belief coupled with the factors discussed above determined when, what, and how much food and beverage Medieval Christians consumed (Cosman 1995: 103). Food items also reflected the social status of the consumer. Sumptuary laws restricted expenditure and served to maintain specific class structures. These laws not only regulated how much money

could be spent on specific items, what fashions of clothing could be worn, controlled dowry amounts, but also what food items could be consumed (Epstein 2009: 156-157, 219).

Additionally, humor, pathos, and social commentary were also associated with consumed food items (Woolgar 2010: 14-16). Cosman (1976) argues that the relationship between food and character is complimented by

> convergences between food and social class, food and sex, and food and sin (p. 103).

Any or all of these factors determined what medieval Christians could put on their tables.

6 Staple Diet of Medieval Europeans

Information regarding the dietary components of the medieval period comes from illustrations, cookbooks, domestic accounts, menus, and archaeological remains. These accounts, however, vary in thoroughness and quality. Medieval dietary reconstruction is, therefore, a complicated endeavor. Despite this, studies of the available literature indicate that the medieval populations had a more balanced diet than populations that preceded or came after them (Mossimo Montanari 2000: 169). Dietary components primarily consisted of cereals, pulses, and meats (Super 2002: 172). Though certain food items varied based on the social and cultural factors discussed above, as well as by what was available regionally and temporally, the food categories identified were similar for all of medieval Europe (see Figure 1).

6.1 Meats

Medieval Christians utilized a variety of animals for protein sources – cow, pig, deer, rabbit and sheep being the most common. When available, bear, ox, beaver, and coney (suckling/nursing infant rabbits) were also eaten (Cosman 1995: 40). Lower class individuals typically used cow, pig, and sheep for various agricultural purposes or the products they produced, such as wool and milk (Epstein 2009: 47) (see Figure 2). It was only until the animal reached the age and/or state where they were no longer useful, that they were slaughtered for consumption. High-class individuals, however, could afford to

purchase or slaughter young animals. Therefore, the tender meat of calf and kid was often present on the tables of the wealthy (Freedman 2007: 16, Woolgar 2007: 165). Pork, the least valued meat item, was considered an appropriate dietary component for the lower class (Civitello 2004: 56). Taboos against the consumption of dogs and cats were widely adhered to (Woolgar 2010: 16). Horseflesh avoidance was also observed (Simoons 1994: 188).

Birds were also a large part of the medieval diet (see Figure 3). It was common to find goose/gander, hen/rooster, gull, bittern, bustern, crane, curlew, heron, lark, mallard, pigeon, plover, quail, sparrow, shoveler, snipe, quail, sorcell, stork, teal, whimbrel, and woodcock on the table of both high and low status medieval Christians (Cosman 1995: 40-41). Cosman (1976) states it was more likely to have market purchased pheasant, peacock, eagle, egret, and partridge as dietary components among individuals comprising the high-class population of medieval Europe. Lower-class individuals could obtain these same species through hunting. Chicken and swan were particular favorites among the wealthy (Civitello 2004: 56). Woolgar (2010) states that medieval Christians of all social classes adhered to corvid taboos.

Medieval Christians exploited many types of sea life. For example, crustaceans, such as lobster, crayfish, shrimp, eel, and crab were frequent dietary components of all medieval social levels. Shellfish were frequently consumed. Cosman (1976) and Woolgar (2010) state these food items included mollusks, mussels, oysters, and clams. Though high status

individuals also consumed the crustaceans and shellfish food items listed above, their sea life dietary components were a great deal broader than those of the lower class (Woolgar 2007: 171). The wealthy consumed more exotic forms of shellfish, whelk, walrus, seal, dolphin, and various species of whale (Cosman 1995: 40).

6.2 Fish

Fish, not classified as meat by medieval populations, provided an excellent source of protein on the days that Christian mandates prohibited meat consumption (Hoffmann 2004: 23) (see Figure 4). Therefore, fish as a dietary component could be linked to a virtuous Christian diet (Woolgar 2010: 7). Hoffmann (2005) states that medieval European population preferred terrestrial meat to fish. Despite this, all social classes incorporated various species into their diets. According to Cosman (1976), this extensive list includes bass, bream, brett, carp, colin, codling, conger, dace, dogfish, doree, flounder, garnfish, gurnard, haddock, hake, and halibut as the more commonly eaten forms. Keeling, lamprey, ling, loach, luce, mackerel, monnow, salmon, smelts, sold, sturgeon, swordfish, tench, thornback, thurlpole, torrentyne, trout, and whiting were also frequently consumed. Turbot, salmon, and trout were particular favorites among the high class (Kiple 2007: 87, Woolgar 2010: 7).

6.3 Animal Products

Meat, in the traditional sense (ribs, haunches, etc.), was not the only part of the animal that was used. Much of the internal anatomy was employed in medieval dishes (Birkhan 1995: 84). For example, giblets, such as guts, livers, hearts, stomachs, and genitalia were often used in stuffing the animals they derived from or as stocks and broths (Cosman 1995: 41-42). Other internal anatomy not considered fit to eat by the upper class, called “garbage” and consisted on entrails and viscera. These foodstuffs were typically sold to tradesmen that baked pies for lower classes to purchase at markets. Cosman (1976) also states that hoofs, feet were used as gelatinous substances used in fruit, meat, and fish dishes. Additionally, natural fats and oils from various types of meat and fish were employed in food preparation that required frying, sautéing, and baking. Blood from various animals could be diluted with another substance to serve as the base for stuffings or gravies (Birkhan 1995: 84). On its own, blood was used for creating the desired brown or black coloring of sauces, or was merely included for flavor (Cosman 1995: 42).

Milk, eggs, and cheese were the primary animal products utilized by the medieval Christians, but, like meat, their consumption was restricted during Lent (Kiple 2007: 86). Cow’s milk was employed, but sheep and goat milk was preferred (see Figure 5). Milk was plain, skimmed, creamed for making various forms of butters and cheeses (Civitello 2004: 65). Milk curds were also added to sauces and puddings. Heated milk was also added to wine with spices to

produce a much-favored beverage, or was drunk on its own (Cosman 1995: 42).

Eggs were especially prevalent in medieval diets. This food item was consumed in various forms. Though also eaten alone, an examination of assorted medieval recipes reveals that eggs are called for in raw, whole, white, yolk beaten, whisked, soft-boiled, hard-boiled, chopped, roasted, blown, and stuffed fashions. Eggs were also used in flourishings, or embellishments of glazes found in breads, pastries, as well as meat, poultry, and fish dishes (Cosman 1995: 42). For all meals and all types of dishes, eggs were used in abundance. Additionally, both chicken and sparrow eggs were considered to have aphrodisiac properties. Eggs from these two bird species were also used for these purposes.

6.4 Fruits, Vegetables, and Nuts

It had been previously thought that the lack of fruits and vegetables in medieval recipes meant that these food items were not consumed, or at least not eaten often. According to Cosman (1976), an analysis of medieval maps of orchards and gardens coupled with depictions of harvest scenes in tapestries, however, paints a different picture. Moreover, the fact that there were market laws governing the sale of items in this food category indicates that fruits and vegetables were a common dietary component. Popular vegetables included lettuce, cabbage, peas, green beans, celery, carrots, cucumber, spinach,

radish, leek, parsnip, endive, chicory, olives, beets, turnips, and lentils (Cosman 1995: 47-49, Woolgar 2010: 10). According to Super (2002), onions were considered to be one of the lowest foods produced by the earth, and therefore suited as a dietary component of the lower class.

The fruit most used in the diet of medieval Europeans was grapes, but was primarily used for wine. Other favorite fruits employed in specific dishes, such as pies, compotes, stews, and stuffings, or eaten on their own, were apple, pear, date, fig, strawberry, hurtleberry, mulberry, bog berry, plum, cherry, peach, quince, medlar, pomegranate, and service (Cosman 1995: 48, Woolgar 2007: 175). Though fruits were considered more suitable dietary components for the upper class, and vegetables for the lower, members of all social classes could easily incorporate this food category into their diet, as these items could be both purchases at market or grown in private gardens (Civitello 2004: 56)

Nuts were a common dietary component. Though almonds were a particular favorite, as found by their presence in one-third of all medieval recipes, chestnuts, filberts, and walnuts were also eaten (Cosman 1995: 49).

6.5 Bread and Cereals

Medieval Christians of all social classes consumed a number of bread varieties (Civitello 2004: 66, Woolgar 2007: 172). This food item could be eaten on its own, typically with a butter spread, but was also a main ingredient

in many medieval dishes. According to Cosman (1976), bread was also used in stuffings, compotes, and stews when crumbled and/or infused with herbs. When soaked in milk, wine or vinegar, this food item served as a thickener. Toasted bread was utilized to absorb juices from other types of food, such as those produced by meat, or to add texture to soups and gravies. Cereals employed in the making of bread or brewing ale consisted of spelt, wheat, oat, rye, and barley (Kiple 2007: 88).

6.6 Beverages

Though medieval Christians did drink water and almond milk, the most common beverages consumed were wine, ale, and beer. This did, however, vary regionally. Hieatt (2002) states that ale and beer were consumed both as a beverage and as a cooking ingredient in Britain, but had no place in France. French people condemned these beverages as having foreign tastes (Scully 2002: 59). Wine was the most consumed beverage in this region. According to Chabran (2002) and Varey (2002), the same can be said for Spain and Italy, as medieval populations in these countries also incorporated wine into their diets in the forms of beverage and cooking ingredient. Beer, the primary drink of Germany, was used as a liquid food additive, or drunk on its own (Weiss Adamson 2002: 168).

6.7 Herbs and Spices

Herbs and spices were used in a majority of medieval dishes. Though many imported herbs and spices were far too expensive for the lower class populations, many were within their means to purchase or could be grown in home gardens (Woolgar 2010: 8). These included parsley, mint, dittany, thyme, alecost, garlic, pepper, and rosemary.

Imported spices were extremely expensive. Their uses in dishes among the wealthy were, therefore, not only for taste, but also served as indicators of conspicuous wealth and ostentatious waste (Cosman 1995: 45). These spices, primarily imported from the East, included cinnamon, ginger, saffron, and nutmeg (Woolgar 2007: 181). Such spices were not only used for flavoring food, but were also used to enhance the taste of beverages, such as cider, ale, wine, and various forms of fruit and/or flower juices (Woolgar 2007: 177).

In addition to their use as seasonings for food and beverages, herbs and spices were prominent ingredients medicinal concoctions. It was knows in the medieval period that food, at times, had ill effects on the internal conditions of the body (Scully 1995: 7-8). Particular spices were employed to counteract ailments, such as indigestion and heartburn, or counteract overeating (Cosman 1995: 45-46). Foods were also thought to possess four contradictory qualities. These were hot, cold, moist, and dry (Scully 1995: 6). Resulting from this was the need to balance the attribute of the food with its opposite kind. Therefore, if a moist food was consumed, a spice categorized as dry was used

to not only add flavor, but to complement its particular quality (Weiss Adamson 1995: 13-14).

7 Medical Literature Regarding the Dietary Practices of Medieval Christian Women

According to Garay and Jeay (2007), the dietary practice of medieval pregnant women has proved a difficult area for scholars to discern with any certainty for multiple reasons. First, the ill effects of pregnancy have not always been considered occurrences that could be prevented or alleviated. Pregnancy was risky. Therefore, the associated dangers that accompanied gestation were considered natural and unavoidable (Bardsley 2007: 83). Secondly, many cultures regulate pregnancy solely to the world of women. As a result, medical advice and/or remedies rested in the realm of women's popular wisdom (Hanawalt and Dronzek 1999: 32, Garay and Jeay 2007: 425). These were not always written down, as many women, excepting those of the educated upper class, were not literate. Finally, even if similar food items were available, dietary practices among pregnant women varied regionally. As food guidelines for expecting women were not typically written down, it is difficult to determine what was actually consumed and what was avoided.

Despite these obstacles, scholars have been able to piece together some information regarding dietary practices of pregnant women in the medieval period through texts deriving primarily from Arabic, Latin and vernacular pregnancy-regimes that have foundations in Greek, Roman, and Byzantine sources (Garay and Jeay 2007: 424, Weiss-Amer 1993: 5). In the

early medieval period, Arabic physicians established pregnancy dietary regimens based on Galen's six non-naturals (Weiss Adamson 1995: 48). Consequently, this made pregnancy a component of preventative medicine. Particular emphasis was placed on morning sickness, which was categorized as a form of eating disorder. These texts listed recommended food, food to be avoided, and treatments to ease pregnancy induced nausea and/or vomiting (Weiss-Amer 1993: 19). European medical standards closely followed those instituted by Arabic models and continued to approach pregnancy and morning sickness from a preventative medicine standpoint. Latin regimens, following in popularity from Arabic regimes, were written largely for professional male audiences. According to Weiss-Amer (1993), the onset of the plague ushered in the need for vernacular translations, and the merging of professional medical literature with those of the clerical. This change brought about a shift in medical focus. Women became the central subjects in vernacular medical texts. As a result, regimes regarding pregnancy were no longer considered preventative medicine. Medical practices regarding human reproduction and women's health became a field unto its own. It is these texts that provide insight into medieval perceptions concerning dietary components and dietary aversions during pregnancy.

7.1 Dietary Components and Dietary Avoidances of Medieval Christian Women

Early medieval medical practices regarding pregnancy and morning sickness was placed in the context of preventative medicine. Therefore, much of the medical literature has a strong emphasis on nutrition, as this was believed to be key in staving off pregnancy-induced nausea and vomiting, as well as producing positive pregnancy outcomes. As most medieval medical practices were greatly influenced by Arabic models, Rhazes, a tenth century author of one of the first medical texts to include a pregnancy-regimen discussing dietary components and aversions, was held in high esteem by medieval populations. Rhaze's work would also serve as the basis for medical literature regarding the proper diet during pregnancy following his time (Weiss Adamson 1995: 57).

This medical practitioner advises pregnant women to avoid any food items that are acidic and bitter. These foodstuffs include capers, lupines and unripe olives. Additionally, any food items that promote urination and menstruation, such as green beans, rue, and chickpeas, should not be eaten throughout the entire course of gestation. Rhazes also warns pregnant women against

> bad foods and the mixing of bad and diverse foods in the stomach (Weiss-Amer 1993: 14).

Dietary components believed to promote positive pregnancy outcomes and reduce nausea and/or vomiting include syrups or styptic food, as well as good, fragrant, and slightly diluted wine. Rhazes also recommended the meat of chicken, partridge, and kid (baby goat) to suppress nausea. Furthermore,

small meals should be eaten throughout the day, rather than partaking in one large meal once a day.

One of the most influential medical texts for Arabic and European populations, according to Weiss-Amer (1993), was Haly Abbas' tenth century *Liber pantegni*. This work largely echoes the dietary warnings and recommendations of Rhazes. For example, food items that promote menstruation, such as rue, celery, black chickpeas, fenugreek, and green beans should not be consumed by expecting women. Additionally, diuretic and bitter foods should equally be avoided. Concoctions to prevent pregnancy induced nausea and/or vomiting include ingredients, such as the syrup of pomegranates, aloe, nutmeg, and other fragrant substances. Dietary components conducive to decreased symptoms and/or occurrences of morning sickness and positive pregnancy outcomes are identified as chicken and kid with vinegar made from grapes and slightly diluted wine (Weiss-Amer 1993: 14-15).

Avicenna, another popular and respected administrator of medical advice regarding the dietary practices of medieval pregnant women, emphasized corrective nutrition, particularly regarding common, pregnancy induced eating disorders. For example, loss of appetite was thought to be a side effect of nausea and vomiting. Weiss-Amer (1993) states that it was believed that eating foods that whet the appetite, such as sweet quinces, apples, pomegranates, raisins, and pears would restore the expectant women

to normal consumption rates. In other respects, Avicenna's recommendations mirrored those put forth by Rhazes and Abbas (Weiss Adamson 1995: 70). Menstruation provoking foods, such as sesame, green beans, and chickpeas were to be avoided, as were acrid and bitter capers and unripe olives. Also similar is Avicenna's instructions for pregnant women to drink good, fragrant, and old wine.

Bernard de Gordon's nutritional guidelines, put forth in his *Lillum medicinae*, differed from the recommendations outlined by the above medical practitioners. Instead, he promoted the consumption of roasted, fried, and fragrant food items (Weiss-Amer 1995: 16). Gordon also recommended eating pomegranates, cooked pears, roasted hazelnuts, roasted chestnuts, and roasted chickpeas after meals to reduce nausea and/or vomiting. Another author, Aldebrandino de Siena, while concerned with the diets of pregnant women, deviated from the common nutritional standards. According to Weiss-Amer (1995), Siena advised against eating food items containing high amounts of salt. If the expecting woman consumed too much salt, her baby would be born without nails (Weiss-Amer 1995: 17).

As previously stated, not all medieval women had access to professional medical care or possessed the ability to read the available medical literature produced by the authors discusses above. Therefore, some, particularly those of the lower classes, relied on the experience of wisdom of other women who had already gone through pregnancy (Garay and Jeay

2007: 428). *The Distaff Gospels*, a fifteenth century work consisting of more than 200 “gospels” giving advice to expecting women regarding pregnancy and health, was a result of a group of women who met during winter evenings to spin (Garay and Jeay 2007: 423). Through these meetings, the information shared with one another brought about a guide to female medical lore in the medieval period. Though this work does not solely focus on dietary components and aversions, a few references to particular food items are present.

> Her diet must not include hare’s head, which are certain to cause the child to be born with a split lip, nor should pregnant women be given fish heads to eat for fear that, as a result of their imagination, their children will be born with mouths more turned up and pointed than normal.
>
> If a woman thinks that she is pregnant, she must not eat soft cheese because, if she carries a boy, he will have a short small member, and if it is a girl, her crack will be wide, deep, and lean.

While these dietary recommendations are obviously not based in scientific fact, it is interesting that the food items to be avoided are meats (rabbit and fish), and an animal product (cheese).

8 Conclusion

Without determining rates of food aversions, nausea and vomiting in pregnancy, and positive versus negative pregnancy outcomes of women who experienced morning sickness, it is not possible to draw absolute conclusions regarding the applicability of Fessler's hypothesis to medieval Christian women. Based on the fact that Fessler's (2002) study sample of 73 societies are all small in scale, it is not certain that his hypothesis would produce similar results if women comprising the study sample were derived from large-scale societies (see Table 7). Flaxman and Sherman's 2000 study has potential for substantiating that Fessler's hypothesis – that meat and animal product aversion and nausea and vomiting during pregnancy developed as an evolutionary adaptation to protect both mother and embryo from potential pathogen transmission – can be applied to large-scale societies, as these social structures were present in their study sample. Nevertheless, the majority of women examined in Flaxman and Sherman's (200) study came from small-scale societies. Therefore, their findings are conceivably biased. Lacking the quantitative data employed by Fessler (2002) and Flaxman and Sherman (2000), it has been necessary to draw upon knowledge of staple dietary components, Christian food proscriptions, and medical literature regarding what food items should be consumed and which should be avoided in determining whether or not Fessler's hypothesis could potentially prove true

in large-scale societies. From the lines of evidence listed above, the answer points to a negative outcome.

Though consumption variations based on economic means and social class must be taken into account, information regarding the staple diets of medieval populations reveals a relatively diverse and balanced nutritional regimen, with all major food groups represented. Saving the proscriptions on horseflesh and the consumption of dog, cat, and corvid, medieval populations did not adhere to permanent dietary taboos. Although sumptuary laws limited the dietary components of the middle and lower classes, they did not eliminate entire food categories. Individuals of the middle and lower classes were fully capable of receiving nutrients in foods denied them by supplementing another item containing similar nutritional properties from the same dietary category. Furthermore, sumptuary laws limited other aspects of social life, such as dress and dowry amounts. These regulations, therefore, were imposed to maintain prevailing social constructs, although they also dictated food items incorporated in the diet.

Christian religious canons called for avoidances of meat and animal products, such as cheese, eggs, and milk. These abstentions, however, were relegated to specific days of the week or times of the year in observance of sacred days or holy seasons. Furthermore, although the food items prohibited from consumption were essentially those that were protein right, this nutrient

could easily be obtained by eating fish, which is what typically occurred, as medieval Christians did not consider fish to be meat.

Fessler and Navarrete (2003) claim that emotions of ambivalence and disgust toward meat and animal products have been put in place by evolved traits of the human mind that have been shaped by adaptive circumstances experienced by human ancestors. Meat and animal products are hosts to bacteria and other pathogens and, therefore, pose the greatest threat of bacteria and other pathogens and, therefore, pose the greatest threat of pathogen transmission. As a result, evolutionary adaptations such as psychological mechanisms that brought about, reproduced, and disseminated hypersensitive feelings of ambivalence and disgust, have been selected for in order to protect consumers from ingesting the types of food items that have the greatest probability of having negative effects on health. Although such feelings affect the whole of humanity, Fessler and Navarrete (2003) claim that they are particularly marked among pregnant women.

For this to be true for expectant women in medieval Christian Europe, it should be found that pregnant women avoided meat and animal products. Medieval dietary recommendations regarding the dietary components of pregnant women, however, do not conform to this viewpoint. In fact, meat and animal products were not only a large component of the staple diet, but were also recommended as dietary components to be consumed by pregnant women to prevent and ease morning sickness and promote positive

pregnancy outcomes. In the medical literature reviewed, multiple practitioners advocate the inclusion of chicken, partridge, and kid into the diet. As seen in the discussion of *The Distaff Gospels*, hare and fish head, as well as soft cheese were to be avoided. Though it is interesting that these food items are from the meat and animal product category, the reasoning for their elimination in the diets of pregnant women was centered upon the detrimental effects on the physical appearance of the child, rather than health concerns. Therefore, this text, while offering insights into the dietary habits of lower class pregnant women, is a product of wives' tales. The medical literature produced from medical practitioners contradicts Fessler's hypothesis. These texts provide supporting evidence for the benefits received by expectant women who consumed meat during their pregnancies, as these recommendations were based upon observations made from a scientific perspective.

This paper does not question the validity of Fessler's hypothesis in regard to small-scale societies. His findings (2002), as well as Flaxman and Sherman's (2000), provide evidence to support the idea that evolutionary adaptations have, in fact, been selected for in order to protect pregnant women and their embryos from pathogen transmission by eliciting sentiments of disgust toward these food items. This thesis has examined the dietary regimes of medieval pregnant women from Christian European nations to determine whether this hypothesis can be applied to cultures with large-scale social structures. The incorporation of a variety of meat and animal products in

the staple diet, the lack of permanent dietary taboos, and the recommendations in the medieval medical literature that this food category was efficacious in preventing and/or easing pregnancy-induced nausea and vomiting, and in promoting positive pregnancy outcomes, all suggest that Fessler's hypothesis is not applicable to large-scale societies.

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APPENDIX

Table 1

General Food Categories and Targets of Taboos (Fessler 2002: 22)

Region and Type of Report	Number of Societies	Target						
		Meat	Vegetables	Fruit	Dairy Products	Sweets	Spicy Foods	Starches
North Africa								
Type A[1]	1	–	–	–	–	1	–	–
Type B[2]	1	1	–	–	–	–	–	–
Sub-Saharan Africa								
Type A[3]	6	4	1	1	1	1	–	–
Type B	–	–	–	–	–	–	–	–
Europe and Euro-America								
Type A[4]	1	–	–	1	–	–	–	–
Type B	–	–	–	–	–	–	–	–
Middle East								
Type A[5]	1	–	–	–	–	–	1	–
Type B	–	–	–	–	–	–	–	–
East Asia								
Type A[6]	2	–	1	–	–	–	1	–
Type B	–	–	–	–	–	–	–	–
South Asia								
Type A[7]	1	–	–	–	–	–	1	–
Type B	–	–	–	–	–	–	–	–
Southeast Asia								
Type A[8]	1	–	–	–	–	–	1	–
Type B[9]	1	1	–	–	–	–	–	–
Australia								
Type A	–	–	–	–	–	–	–	–
Type B[10]	1	1	–	–	–	–	–	–
Oceania								
Type A[11]	1	1	–	–	–	–	–	–
Type B	–	–	–	–	–	–	–	–
Central America								
Type A	–	–	–	–	–	–	–	–
Type B[12]	1	1	–	–	–	–	1	–
South America								
Type A[13]	5	3	1	–	1	1	1	–
Type B	–	–	–	–	–	–	–	–
North America								
Type A[14]	2	1	–	–	–	–	2	–
Type B	–	–	–	–	–	–	–	–
Total	25	13	3	2	2	3	8	0

NOTE: Type A, concordance among ethnographies; B, lack of concordance among or within ethnographies.
SOURCES: 1, Calame-Griaule and Dieterlen (2000[1960]), Paulme (1940), van Beek (2000[1992]), Bohannan and Bohannan (1969); 2, Kaufman (2000[1960]), Hanks (2000[1963]); 3, Kagwa et al. (1934), Mair (1934), Gilks and Orr (1931), Merker (1910), Spencer (1998), Aunger et al. (1999), Israel and Nestor (1982*a*), Demissie, Muroki, and Kogi-Makau (1988), Ominde (1952); 4, Laguerre (1984); 5, Abdalla (1982); 6, Pritham and Sammons (1993),Liulan (1999); 7, Stevenson (1920), Briggs (1920); 8, Manderson (1981); 9. Kaufman (2000[1960]), Hanks (2000[1963]); 10, Róheim (1993); 11, Whitehead (2000); 12, Chapin (1983), Nordenskiöld (1998[1938]); 13, Karsten (1932), Peirson (1998[1967]), Elick (1969); 14, Turner (1972), Clark (1959).

Table 2

Meat-Bourne Pathogens and their Potential Dangers to Pregnant Women (Fessler 2002: 27)

Pathogen	Environmental Distribution	Sequelae	Limiting Cytokine Response	Exacerbating Cytokine Response	Period of Most Dangerous Infection
Toxoplasma gondii	All warm-blooded animals can host; common in many mammals and birds[1]	Abortion, stillbirth, congenital deformities, fetal and maternal neurological and retinal damage[2]	Th1:IL-12,IL-6,TNF-alpha, GM-CSF, IFN-gamma, maternal IgG[3]	TH2:IL-4[3]	Early pregnancy[4]
Listeria monocytogenes	Ubiquitous; infects or is endosymbiotic with many mammals and marine organisms; proliferates on meat[5]	Maternal death, abortion, neonatal death, and meningitis; > 25% fatality rate with antibiotic treatment[6]	Th1: IL-12, IFN-gamma, TNF-alpha, IL-8, GM-CSF, IL-6[7]	Th2: IL-10,IL-4[7]	Early pregnancy[8]
Escherichia coli	Ubiquitous; infects many animals; proliferates on meat[9]	Maternal death, intrauterine death[10]	Th1: IL-1, IL-2, IFN-gamma[11]	TH2: IL-10[12]	Early pregnancy[13]
Brucella abortus, B. melitensis	Carried by many mammals and marine organisms[14]	Abortion, fetal death, preterm delivery[15]	Th1:IL-12, IFN-gamma, TNF-alpha[16]	Th2: IL-10, IL-4[17]	?
Shigella dysenteriae	Ubiquitous; often water-borne, but proliferates on meat[18]	Maternal dehydration, electrolyte imbalance, death, abortion, preterm delivery[13]	Th1: IL-8, IL-2[19]		Early pregnancy[13]
Campylobacter jejuni	Ubiquitous; infects or is endosymbiotic with many mammals and birds; proliferates on meat[20]	Maternal dehydration, electrolyte imbalance, death, abortion, preterm delivery, stillbirth[21]	Th1: TNF-alpha, IL-8[22]		Early pregnancy[23]
Clostridium perfringens	Carried by many mammals and birds; proliferates on meat[9]	Abortion[24]	Th1: IL-1, IL-6, TNF-alpha, IFN-gamma[25]		?
Leptospira	Infects many mammals and birds[26]	Abortion, stillbirth > 50% of cases[27]	Th1: TNF-alpha, IL-2[28]		Early pregnancy[29]

SOURCES: 1, Hejlícek, Literák, and Nezval (1997; 2, Remington, McLeod, and Desmonts (1995), Galván Ramírez et al. (1995); 3, Thouvenin et al. (1997), Suzuki (1999); 4, Beazley and Egerman (1998; 5, Cooper and Walker (1998); 6, Farber and Peterkin (1991); 7, Nakane et al. (1999); 8, Abram and Doric (1997); 9, Pepin, Russo, and Pardon (1997); 10, Moyo et al. (1995); 11, Chopra et al. (1997); 12, Zimmer et al. (1996); 13, Sechser et al. (1976); 14, Corbel (1997); 15, Makhseed et al. (1998); 16, Oliveira et al. (1998); 17, Fernandes et al. (1996); 18, Mwenye et al. (1997); 19, Sansonetti et al. (1999); 20, Cabrita et al. (1992); 21, Goh and Flynn (1992); 22, Pancorbo et al. (1999); 23, Simor and Ferro (1990); 24, Lantelme et al. (1995); 25, Wallace et al. (1999); 26, Treml and Nesnalova (1993); 27, Carles et al. (1995); 28, Petros, Leonhardt, and Engelmann (2000); 29, Shaked et al. (1993).

Table 3

Specific Food Items and Targets of Taboos (Fessler 2002: 23)

Region and Type of Report	Number of Societies	Target						
		Meat	Vegetables	Fruit	Dairy Products	Sweets	Spicy Foods	Starches
North Africa								
Type A[1]	1	1	–	–	–	–	–	–
Type B[2]	1	–	–	–	–	1	–	–
Sub-Saharan Africa								
Type A[3]	17	13	1	5	2	2	2	6
Type B	–	–	–	–	–	–	–	–
Europe and Euro-America								
Type A[4]	3	3	–	–	–	1	–	–
Type B	–	–	–	–	–	–	–	–
Middle East								
Type A[5]	1	–	1	1	–	–	–	–
Type B	–	–	–	–	–	–	–	–
East Asia								
Type A[6]	5	3	–	2	–	–	1	1
Type B	–	–	–	–	–	–	–	–
South Asia								
Type A[7]	5	4	1	3	1	–	–	–
Type B	–	–	–	–	–	–	–	–
Southeast Asia								
Type A[8]	5	5	1	4	–	2	2	2
Type B	–	–	–	–	–	–	–	–
Australia								
Type A	–	–	–	–	–	–	–	–
Type B[9]	1	1	–	–	–	–	–	–
Oceania								
Type A[10]	6	6	1	3	–	–	–	–
Type B[11]	1	1	–	1	–	–	–	–
Central America								
Type A[12]	1	1	1	1	–	–	–	–
Type B[13]	1	1	–	–	–	–	–	–
South America								
Type A[14]	10	9	–	3	–	1	1	–
Type B	–	–	–	–	–	–	–	–
North America								
Type A[15]	3	3	–	1	–	–	–	–
Type B[16]	1	1	–	1	–	–	–	–
Total	62	52	6	25	3	7	6	9

NOTE: Type A, concordance among ethnographies; B, lack of concordance among or within ethnographies.
SOURCES: 1, Calame-Griaule and Dieterlen (2000[1960]); 2, Kaufman (2000[1960]); 3, Brock (1953), Calonne-Beaufaict (1998[1921]), Evans-Pritchard (1998[1932, 1937]), Richards (1939), Helitzer-Allen, Kendal, and Wirima (1997), Israel and Nestor (1981*a*, *b*, 1982*b*, *c*), Costello (1986), Ominde (1952); 4, Pavlovic (1973), Sanders (1949), Fife and Fife (1966); 5, Abdalla (1982); 6, Pritham and Sammons (1993), Wheeler and Tan (1983), Burkhardt (1954), Gould-Martin (1976), Liulan (1999); 7, De Silva (1995), Kar (1993), Ferro-Luzzi (1973), Brown, Shah, and Worth (1968), Rizvi (1979), Panikkar (1918); 8, Adriani and Kruyt (1996[1951]), Man (1975), Bolton (1972), Covarrubias (1938); 9, Róheim (1993); 10, Thompson (1940), Beaglehole and Beaglehole (1938, 1941), Jelliffe and Jelliffe (1964), Blackwood (1935), Schieffelin (1990); 11, Malinowski (1929), Seligmann (1910); 12, Cosminsky (1994); 13, Chapin (1983); 14, Da Silva (1962), Chapman (1982), Jackson (1983), Reichel-Dolmatoff (1971), Becher (1960), Taylor (1950), Parsons (1945), Bianco et al. (1990), Pereira et al. (1989), Kracke (1981), Johnson (n.d.), Elick (1969); 15, Hilger (1951), Clark (1959); 16, Jones (1914), Emmons (1991).

Table 4

Multivariate Regression Analysis of Disgust and Nausea in Pregnancy (Fessler 2005: 348)

	M	S.D.	*t*	*p* value	*β*
General disgust					
1st trimester	17.23	4.35	2.14	.02	.21
2nd & 3rd	16.37	4.12			
Food disgust					
1st trimester	1.88	.79	2.42	.01	.23
2nd & 3rd	1.70	.77			
Animal disgust					
1st trimester	2.13	.80	1.46	.07	.14
2nd & 3rd	2.02	.83			
Body products disgust					
1st trimester	2.97	.92	2.33	.01	.22
2nd & 3rd	2.76	.97			
Sex disgust					
1st trimester	2.33	.53	1.59	.06	.15
2nd & 3rd	2.24	.58			
Body envelope violations disgust					
1st trimester	2.15	.84	1.43	.08	.14
2nd & 3rd	2.04	.82			
Death disgust					
1st trimester	1.85	1.27	0.44	.33	.04
2nd & 3rd	1.80	1.20			
Hygiene disgust					
1st trimester	1.74	1.02	−0.66	.25	−.06
2nd & 3rd	1.80	.93			
Magical contagion disgust					
1st trimester	2.17	.92	1.81	.04	.18
2nd & 3rd	2.01	.93			
Reported nausea					
1st trimester	2.49	3.25	7.53	.00	.69
2nd & 3rd	0.79	1.75			

$N = 496$, $df = 9$.

Responses to the dependent measures ranged as follows: Disgust Scale: 1–7; Nausea: 0–15.

Table 5

Cultures and NVP Data in the Human Relations Area Files (Flaxman and Sherman 2000: 130)

Culture	Location	Staples (eaten every day)					NVP?
		Meat	Milk	Corn	Rice	Other Plant[1]	
Alor	Oceania			X			Yes
Aranda	Australia	X				X	Yes
Bhil	Asia			X		X	No
Burmese	Asia	X			X	X	Yes
Cuna	South America	X				X	Yes
Garo	Asia	X			X	X	Yes
Goajiro	South America	X	X	X			Yes
Gond	Asia				X	X	Yes
Hottentot	Africa	X	X			X	Yes
Ifugao	Oceania	X			X	X	Yes
Kaska	North America	X					Yes
Mbundu	Africa			X			No
Okinawa	Asia	X			X	X	Yes
Omaha[2]	North America			X			No
Papago	North America			X			No
Pukapuka	Oceania	X				X	Yes
Siriono	South America	X		X			No
Tallensi	Africa			X		X	Yes
Tarahumara	North America			X			No
Terena	South America					X	Yes
Tonga	Oceania	X				X	Yes
Toradja	Oceania				X	X	Yes
Trobriand	Oceania					X	Yes
Truk	Oceania	X				X	Yes
Wogeo	Oceania					X	Yes
Woleai	Oceania					X	No
Zulu	Africa	X		X		X	Yes

Table 6

Supporting and Contradictory Evidence for Alternative Hypotheses of NVP (Fessler 2002: 22)

Hypothesis	Supporting evidence	Contradictory evidence	Equivocal findings[1]
Maternal and embryo protection	• Women with NVP are less likely to miscarry • Pregnant women who vomit are less likely to miscarry than those who only are nauseated • NVP and aversions peak when embryonic tissues are most susceptible to harm from teratogens (weeks 6–18) and decrease thereafter (as embryonic susceptibility declines) • Foods commonly found aversive are potential sources of teratogens and pathogens • Pregnant women are immunosuppressed, and the greatest number of aversions are to the foods most likely to contain pathogens (i.e., animal products) • Among societies, absence of NVP is related to increased corn and decreased meat in the diet	• NVP is not consistently associated with lower risk of severe birth defects, low birth weight, or preterm birth	• NVP is not consistently associated with lower risk of minor anomalies or neonatal mortality • Taking certain antihistamines reduces NVP, but does not increase chances of birth defects
Epiphenomenon of a viable pregnancy or of genetic conflict	• Women with NVP are less likely to miscarry but are not at lower risk of anomalies, preterm birth, or low birth weight • Taking certain antihistamines to relieve NVP does not increase chances of birth defects or miscarriages	• NVP is absent in 7 cultures • 90% of women without NVP have viable pregnancies • NVP is not consistently associated with levels of hormones that are necessary for the maintenance of pregnancy • NVP is not reliably associated with age (conflict hypothesis) • NVP and aversions decrease as pregnancy progresses (conflict hypothesis)	• NVP is associated with diet • There are clear and consistent patterns in types of foods that pregnant women find aversive
Prevent sexual intercourse/ Communicate to mate or kin that she is pregnant	• NVP is recognized as a sign of pregnancy	• NVP occurs early in pregnancy, but any risk from intercourse occurs later • NVP is absent in 7 cultures • Other well-recognized, less costly signs of pregnancy are apparent early in pregnancy	• NVP is associated with diet • There are clear and consistent patterns in types of foods that pregnant women find aversive

[1] "Equivocal findings" are findings not predicted by the hypothesis, but also not contradictory to critical predictions of the hypothesis.

Table 7

The Pros and Cons of Fessler's Hypothesis (Responses to Fessler, 2002)

Name and Affiliation	Pro	Con
Tracy M. Bailey and Louise Dye *School of Psychology, University of Leeds* (Fessler, 2002)	Data indicates • Positive correlation of gestational food aversions and NVP in 87% of women. • Close temporal association between onset of NVP and onset of gestational food aversions in 64% of women	• Gestational food aversions may be a by-product of pregnancy sickness. • Unlike that " the misfiring of a mechanism designed to detect meat odors " (p. 40), would affect a significant proportion of pregnant women. • Food aversions may be accidental and not purposeful by-products of sickness. • Mechanism of classical conditioning.
Judith K. Brown *Department of Sociology and Anthropology, Oakland University* (Fessler, 2002)		• Offers no psychological explanations of NVP. • NVP is absent in some societies. • Some societies in northern latitudes do not have many substitutions for meat. • Populations in many areas of the world do not consume dairy products
Samuel Flaxman *Department of Neurobiology and Behavior, Cornell University* (Fessler, 2002)	• Independently replicates research conducted by Flaxman and Sherman. • Cross-cultural analysis adds to information dietary patterns of non-Western pregnant women. • Addresses ○ NVP typically occurs when pregnant women and their embryos are most vulnerable to pathogens. ○ Humans have been exposed to contaminated meats frequently enough through evolutionary history to develop adaptive aversions. ○ NVP is positively correlated with positive pregnancy outcomes.	

Table 7 (continued)

Name and Affiliation	Pro	Con
Brigitte Leeners *Gynecologist/Obstetrician, Universitat Frauenklin* (Fessler, 2002)		• Does not address the relevance of NVP in psychosocial/psychosomatic contexts.
Rosella E. Nappi *Department of Obstetrics and Gynecology, IRCCS Pocliclinico S. Matteo, University of Pavia* *(Fessler, 2002)*		• The capacity of pregnant women to adjust to the intensity of activated adaptive circuitries during the immunogenic process may be a response to the physiological demands of reproductive performance.
Kathleen O'Connor *Center for Studies in Demography and Ecology, Department of Anthropology, University of Washington* (Fessler, 2002)	• Maternal-fetal conflict theory fails to account for meat aversion.	• Fessler's theory is undermined by hormonal data ○ Positive correlation between hCG levels and NVP. ○ The maternal-fetal conflict theory offers specific evolutionary mechanisms that incorporate hCG into an adaptive complex. ○ Progesterone peaks in the first trimester, but continues to increase and reaches its highest level just before birth. ○ Progesterone levels, and NVP are lowest in non-Western populations that have high exposure to pathogens. ○ Cited research is largely anecdotal accounts found in ethnographic literature

Table 7 (continued)

Name and Affiliation	Pro	Con
Daniel W. Sellen *Department of Anthropology, Emory University* (Fessler, 2002)		• Immune suppression may function as a nutrient-sparing adaptation. • Marginally nourished populations are immune-suppressed, more susceptible to pathogenic infection, and if infected, prone extended and severe illnesses. • Symptomatology is increased among the undernourished. • Trace elements highly bioavailable from meat are critical determinants of uterine and post-neonatal growth and cognitive development.
Paul W. Sherman *Department of Neurobiology and Behavior, Cornell University* (Fessler, 2002)	• NVP are uniquely associated with specific food aversions that appear in the first trimester and usually disappear in the third trimester. • During pregnancy, meat is the most common food aversion. • Cultural food taboo. • Smells/tastes of meats are particularly aversive.	• One of the most common gestational cravings includes dairy products.
Beverly J. Tepper and Susan Crystal-Mansour Department of Food Science, Cook College, Rutgers University (Fessler, 2002)		• Pregnant women are no more vulnerable to infection by most food-borne pathogens than the general population. • Pathogens that can produce serious illness in the mother and fetus are not unique to meat. • Gestational food aversions/cravings assumes an extraordinary level of precision in the nutrient regulatory system that has yet to be demonstrated in humans. • It is possible that mood may be more predictive of food aversions.

Figure 1

Medieval Feast in the Court of the Monarch (Cosman 1976: 34)

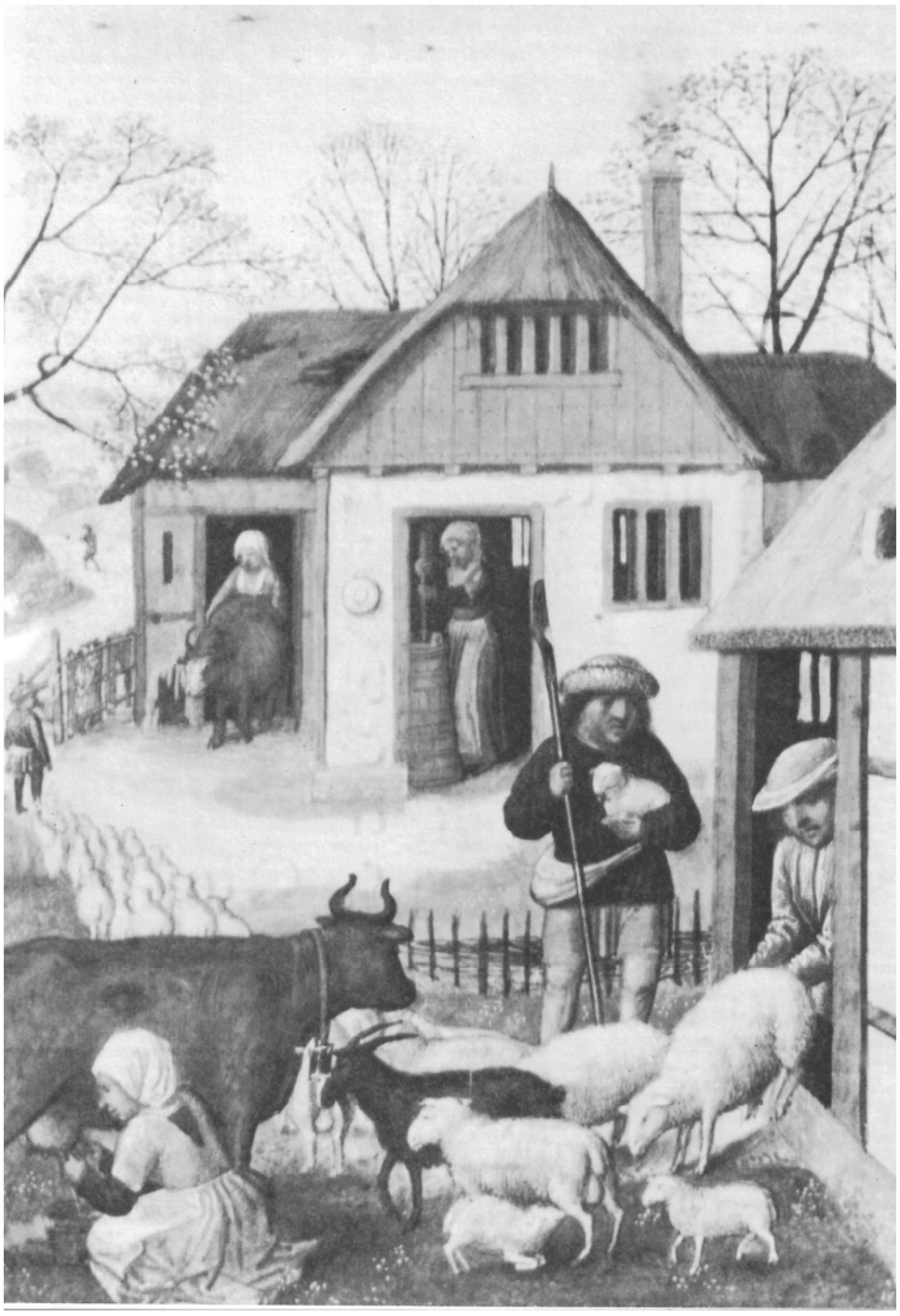

Figure 2

Peasants and Livestock (Cosman 1976: 38)

Figure 3

Hunting for Birds (Cosman 1976: 42)

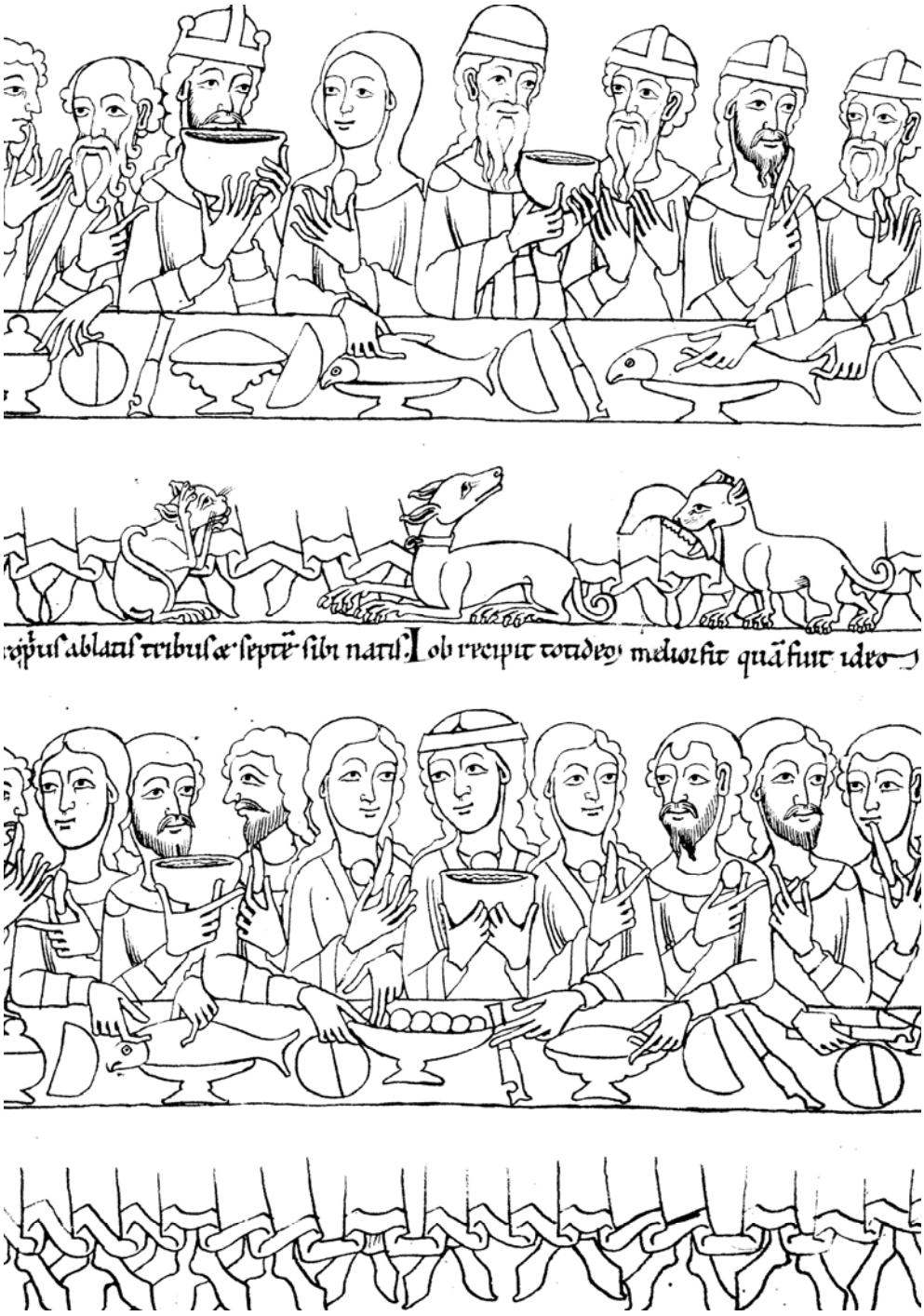

Figure 4

Feasting on Fish (Cosman 1976: 19)

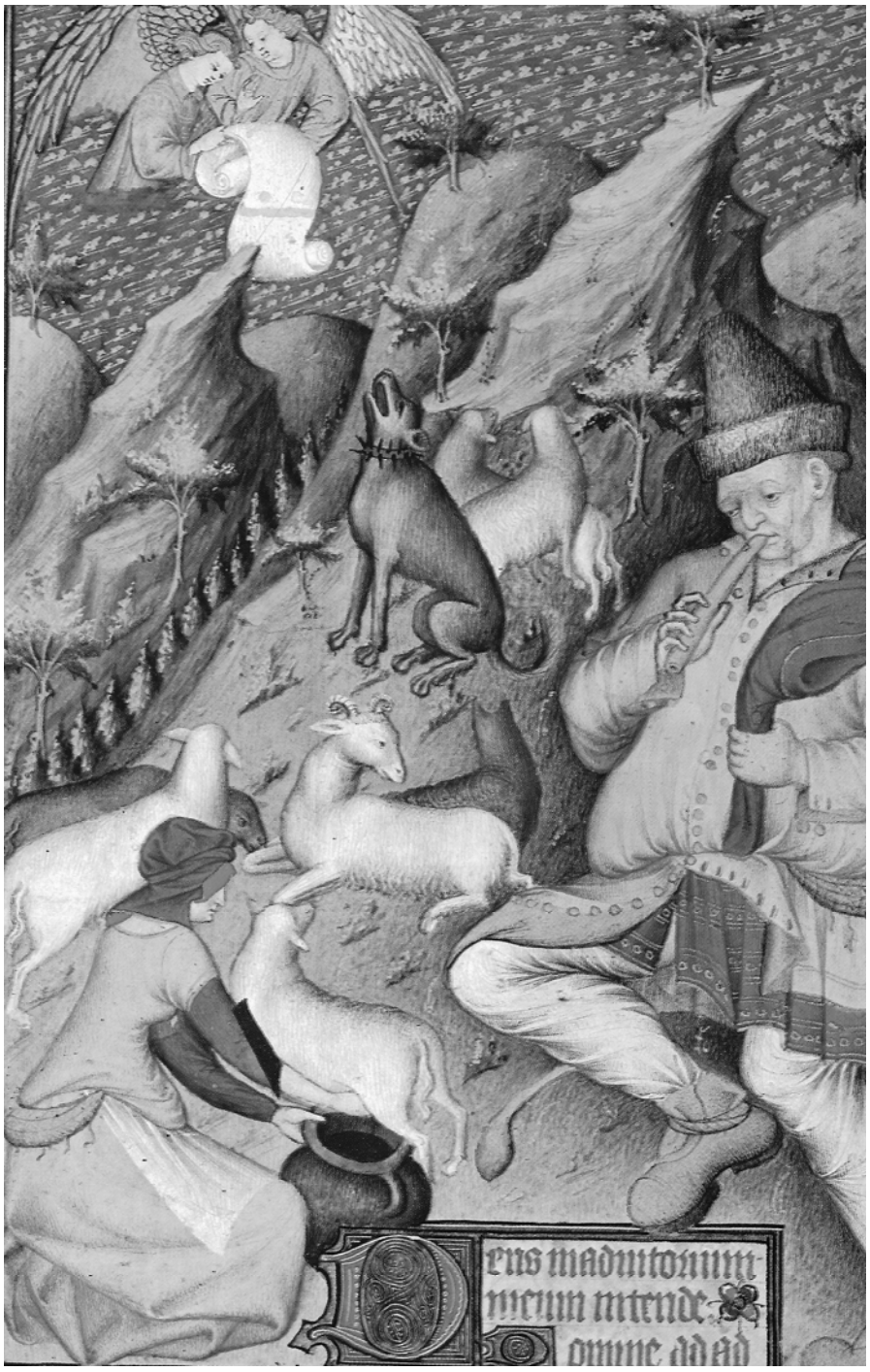

Figure 5

A Shepherd and Shepherdess Tending their Goats Under the Watchful Eyes of Angels (Cosman 1976: 40)