

Assessing knowledge, beliefs and practices related to the consumption of sheep and goat meat in Senegal

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ABSTRACT

A Rapid Integrated Assessment (RIA) of nutrition and health risks and benefits was carried out in 2013 in sheep and goat agri-food systems in urban and rural Senegal. This included: i) testing small ruminants ($n = 384$) for brucellosis, ii) focus group discussions of mothers covering knowledge, attitude and practices related to preparation and consumption of animal source food. No antibodies to *Brucella melitensis*, the presumed priority zoonotic pathogen, were found. Comparing the more traditional, livestock-keeping community with the urban, less livestock-dependent community, we found: urban diets were more diverse, relied more on fish versus livestock products, and used modern products such as yoghurts. Attitudes and beliefs around nutrition and health, strongly shaped the consumption of animal source foods in these contexts.

1. Introduction

Access to diverse, safe and nutritious diets is necessary for health and wellbeing. Animal source foods (ASF) are rich in micronutrients and high biological value protein. Among children, consumption of milk is associated with greater height, and consumption of meat with better cognitive development (Grace et al., 2018). However, in most low-income countries, and particularly in more remote areas where populations are vulnerable, consumption of ASF is still limited. Beyond food availability and accessibility, the safety of food products is essential prerequisite for food and nutrition security (Grace, 2015). Only recently is the health burden of foodborne disease becoming understood. A global report under the aegis of the World Health Organization assessed 31 foodborne hazards and found they were responsible for about 600 million foodborne illnesses and 420,000 deaths; 40% of the burden fell on children under five years of age with the greatest per capita burden in sub-regions in Africa, followed by sub-regions in South-East Asia and the Eastern Mediterranean D subregion (Havelaar et al., 2015).

Fresh vegetables and ASF are the foods most often implicated in foodborne illness and zoonoses make up most of the priority foodborne diseases (Grace, 2015; Hoffmann et al., 2017; Havelaar et al., 2015). In developing countries, ASF are mainly sold and purchased through informal markets, where regulation and food inspection are weak or non-existent. In these countries incomes are low, governments weak, and enforcement of regulation poor; as a result, the informal sector is large, accounting for 55% of Sub Saharan Africa's Gross Domestic Product and 80% of the labor force (BAD, 2013; Roesel and Grace, 2015).

In a context of globalization and rapid urbanization coupled with increasing pressure on natural resources (production systems), major shifts in dietary patterns are occurring throughout the world (Kearney, 2010). Beyond food availability, accessibility and choice, food consumption is affected by factors such as geography, demography, disposable income, urbanization, globalization, marketing, religion, culture and consumer attitudes (Kearney, 2010). However, there is limited information on how these determinants interact in different contexts. And at the same time, health risks are likely increasing, especially among vulnerable communities in low-income countries relying on

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food from the informal sector, but also over-consuming industrial food that increases the risks of some non-communicable diseases (Grace, 2015).

Consumption practices are strongly linked to the beliefs and habits of communities. For example, in some pastoral communities of West Africa (e.g. Fulani of Mali), people prefer to consume raw milk as it is perceived to be more nutritious than boiled milk and believed to have therapeutic properties (Fokou et al., 2010). It is also believed that boiling milk may cause udders to dry and stop giving milk (Fokou et al., 2010; Koné et al., 2015). Those beliefs and practices embedded in local cultures could foster or hinder human wellbeing and health. The focus on sociocultural aspects of food consumption raises the question of the role of knowledge, attitude and practices of communities related to the consumption ASF and associated health risks.

This paper presents the findings from a rapid and integrated food safety and nutrition assessment of risks and benefits associated with consumption of small ruminant food products (meat and milk) among children and adults in two different populations in Senegal: urban (ASF consumers) and rural (livestock keeping communities). The rapid integrated assessment was developed as an ‘appropriately imprecise’ small to medium study, multi-disciplinary using participatory methods that allows collection and analysis of information quickly (2–4 months) and at relatively low cost (10–20,000 USD). The study integrated nutrition of children, knowledge, beliefs and practices around ASF and health risks related to brucellosis in sheep and goat. It was one of six linked studies conducted in high priority value chains in Africa and Asia (see editorial in this issue for further details).

2. Methods

2.1. Study design and study area

The assessment was conducted in two regions in Senegal in June and July 2013, using tools adapted from a multi-country study (Häslar et al., 2018); it included the collection and analysis of blood samples from sheep and goats to identify the presence of one major zoonotic pathogen and a qualitative assessment using focus group discussions (FGD) with mothers to explore knowledge, attitudes and practices (KAP) around consumption of livestock products and child feeding in general and small ruminant products in particular. The study took place in four villages in the Tambacounda region (Missirah, Gabou, Kothiary and Kouthiaba) and in four peri-urban areas in the Dakar region (Ngor, Guediawaye, Tivaoune Peulh and Malika) (Fig. 1 and 2). The Dakar region, including the capital Dakar and its suburbs, is located on the Cap-Vert peninsula. With 3,215,250 inhabitants (estimates of 2011) living on 550 km², it represents 0.3% of the Senegal area and 21% of its population (Fiorentino et al., 2013). Tambacounda region covers the eastern part of Senegal and is 450 km distant from Dakar. The population was 651,018 inhabitants in 2010 of which 83% live in rural areas (USAID, 2010; ANSD, 2015). Due to climatic conditions and the low population density (15 inhabitants/km²) (ANSD, 2015), Tambacounda is one of the most important livestock production areas of the country. The two regions were purposely selected: the rural site of Tambacounda, comprising predominantly livestock keepers, was chosen because of the large small ruminant population while the urban site of Dakar was chosen for the low presence of small ruminant farms, the

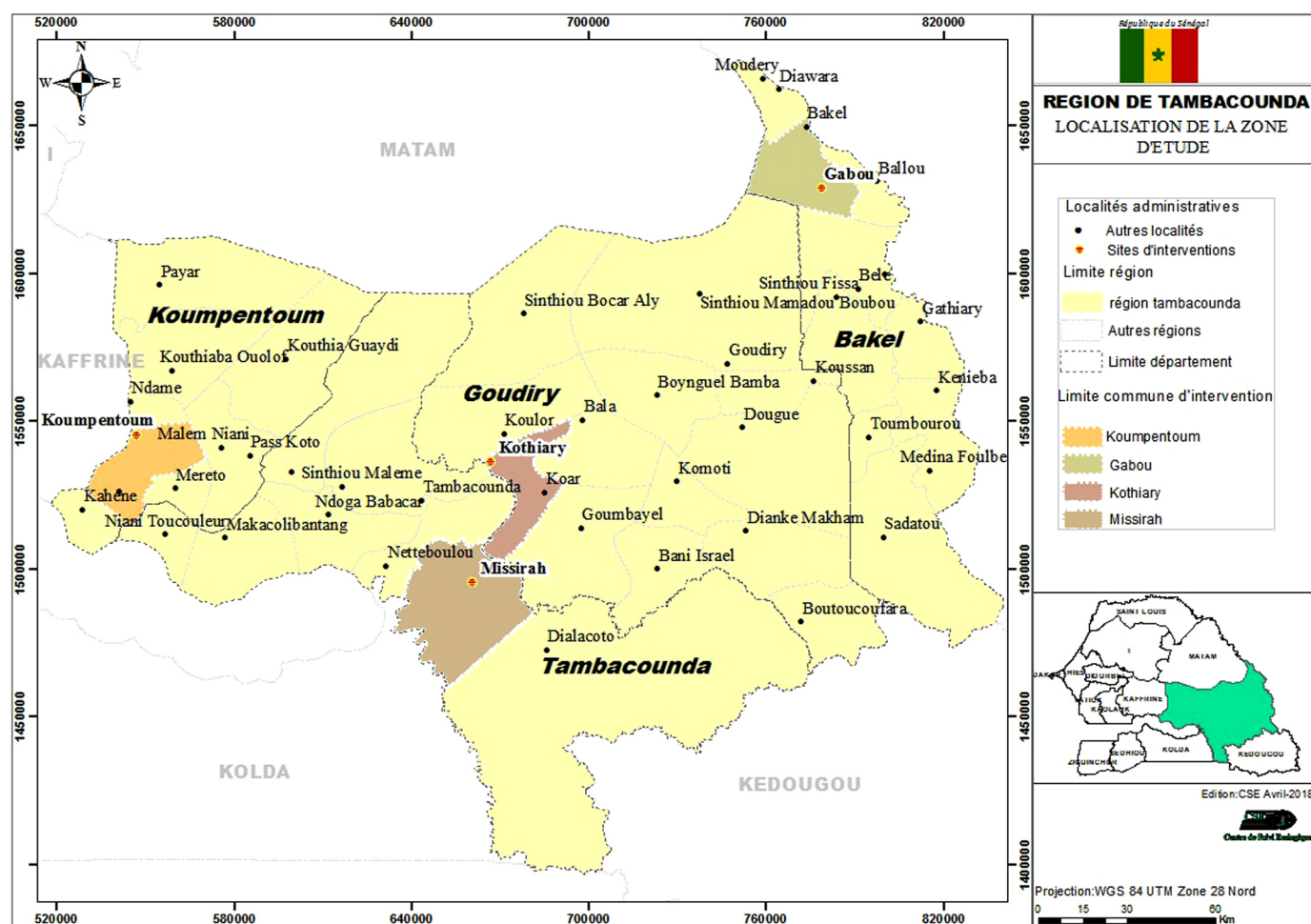


Fig. 1. Map of Tambacounda.

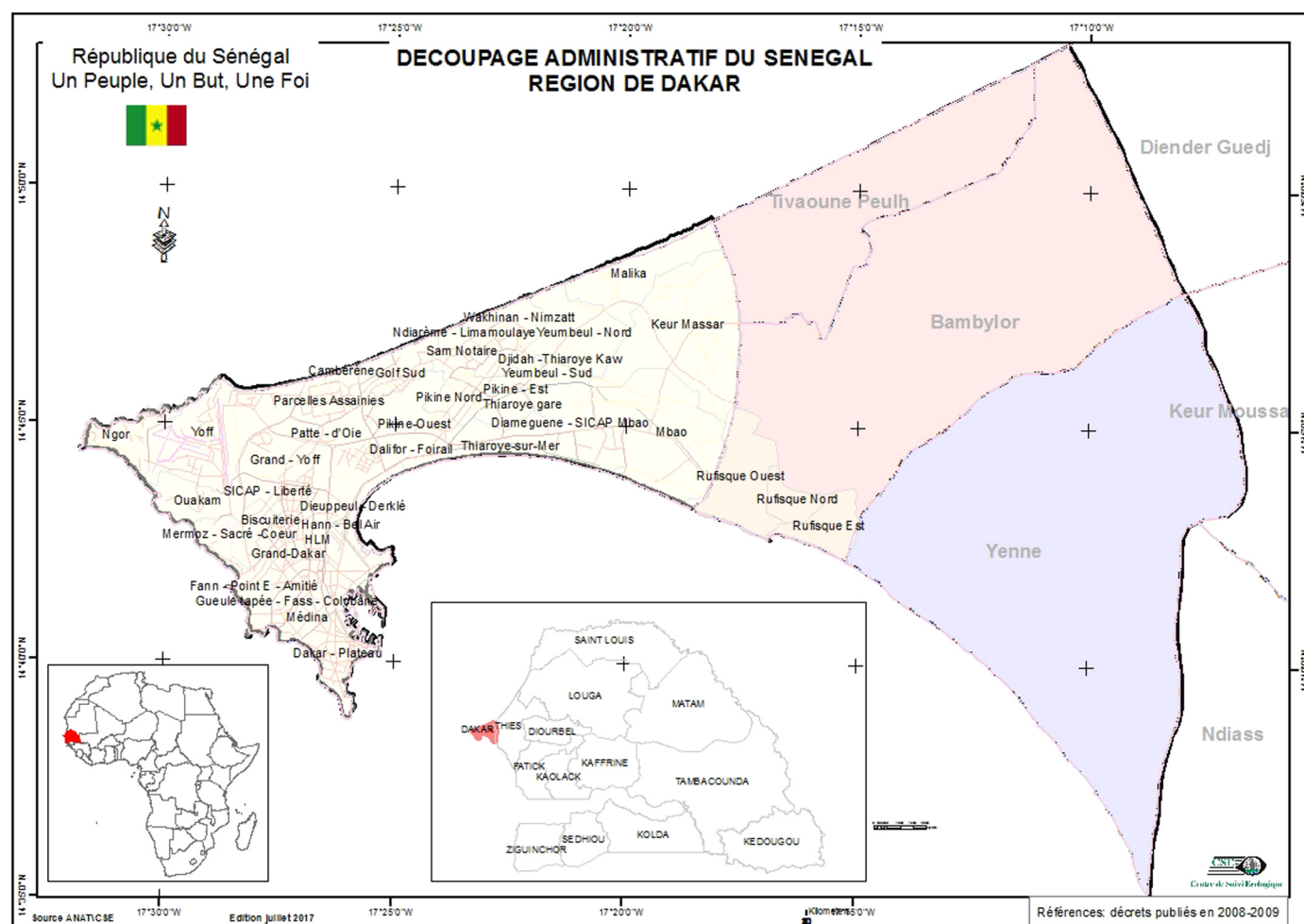


Fig. 2. Map of Dakar.

highest population density (5704 people/km²) in 2013 (ANSD, 2013) and high numbers of ASF consumers.

2.2. Collection and analysis of qualitative information

With the support of the local government veterinarian, one FGD was organized with women in each of the 8 selected villages. Each group consisted of 6–12 women having at least one child under 5 years and who were willing to participate in the study. The focus on women was justified by the social division of the labor assigning to women the task of planning and cooking the food for the households. Women are hence more expert in assessing the quality of food consumed by children and the whole family. While the participants in Tambacounda were all from livestock keeping households, the mothers in Dakar were predominantly non-livestock keepers. The discussions were facilitated by a social anthropologist (male) specialized in qualitative research methods, with the support of a field guide (the village veterinarian) and a translator recruited within each community. Our previous experience was that in Senegal, women are able to discuss freely about ASF and feeding habits. That is why we did not find it necessary to require the presence of a female interviewer for data collection. Various group discussions used the same interview guide developed by the International Livestock Research Institute (ILRI) and partners as part of a multi-country project. It included questions on socio-economic and cultural determinants of consumption of foods of animal origin; the role of animal derived foods in the diets of children; perceptions about the different animal food products and their nutritional content and health risks; and the management of risks associated with foods of animal

origin and small ruminant products. The interviews were conducted either in French, or in local languages such as Wolof, Pulaar or Bambara, according to the study site. The discussions were audio-recorded and written notes were taken during the FGDs to aid subsequent transcription of the recordings.

Data recorded during interviews were systematically transcribed into Microsoft Word (Microsoft Corporation, Redmond, WA, USA). The transcripts were then analyzed using MAXQDA software V10 (Verbi GmbH, Berlin, Germany) by codifying data according to a list of codes elaborated from the main ideas emerging from the transcriptions. The codes were then narrowed to four themes for content analysis: (i) Socio-economic determinants of consumption of ASF; (ii) Role of ASF in the diets of children; (iii) Perceptions around taboos, nutrition and health risks related to ASF; (iv) foodborne disease risk management for ASF.

2.3. Health assessment of small ruminant herds

In each of the study villages, with the support of the village veterinarians, one farm keeping small ruminants and willing to participate in the study was identified and animals were tested for *Brucella melitensis*, the causative agent of ovine brucellosis and an important human pathogen. Between 5 and 71 randomly selected sheep and goats were sampled in each selected village (Table 1).

Blood samples were collected in a plain tube and kept at 4 °C until arrival in the lab. Tubes were transparent and kept in ice box with cold conservative. In Dakar region, the delay between sample collection and serum extraction then storage at −20 °C was a maximum of 2 h

Table 1
Number of small ruminants sampled per village.

Village	Region	Small ruminant population ^a	Number of small ruminants sampled
Missirah	Tambacounda	150,000	71
Gabou	Tambacounda	150,000	71
Kothiary	Tambacounda	100,000	47
Kouthiaba	Tambacounda	150,000	71
Ngor	Dakar	10,000	5
Malika	Dakar	67,600	32
Tivaoune	Dakar	114,480	54
Guediawaye	Dakar	67,600	32
Total		809,680	384

^a DSV (2013).

depending on where sample was collected. In Tambacounda region, we traveled with a mobile centrifuge to allow us to extract serum in situ and sera were stored in domestic freezer until departure. The stay there was 4 days. Sera were tested once all samples were collected.

Sera were tested in the laboratory to detect antibodies using Buffered Antigen Test (BAT) and Complement Fixation Test (CFT) on all samples. Positive and negative controls were used according to manufacturer's instructions. The test were carried at Microbiology-Immunology and Infectious disease laboratory of EISMV for BAT and Complement fixation.

The BAT (Se: 89.6% and Sp: 84.5%) is a quick slide agglutination reaction that is used as a first screening test, given its high capacity to detect positive samples. The CFT (Se: 82% and Sp: 80%) allows the detection of animals with more recent *Brucella* spp. infections (i.e. acute infection). Details on the testing procedures are available elsewhere (OIE, 2013).

2.4. Ethical considerations

The study was approved by the ministry of Livestock of Senegal (Authorization No. 1611). We explained the objectives of the study to women and farmer and explained that there were free to participate or not in the study. We requested the authorization of women to audio-record and take notes during the FGDs. Farmers were offered vitamins and dewormers for their animals as compensation for their time spent in participating in the survey.

3. Results

3.1. Socio-economic determinants of consumption of foods of animal origin

Location was the most important determinant of the type of ASF consumed. Urban participants most commonly consumed fish because of its high availability, low price and cultural preferences. As reported in one FGD, “There are many fishers around the village and fish is easier to find [compared to meat]” (FGD in Ngor, Dakar, June 2013). On the other hand, Tambacounda is located at about 450 km from Dakar with limited access to fishery resources. Food preferences therefore were for cattle milk and meat, the area being one of the most important areas for livestock keeping in Senegal.

Farming households in both locations (rural and urban) rarely slaughtered their own animals for consumption, instead buying from the market. In both areas, beef was consumed more frequently than mutton, due to its cheaper price in the market; sheep meat was mainly consumed during major socio-cultural events such as *tabaski* (*Aïd al-Adha*, that is, the Muslim feast of Sacrifice), weddings and baptisms.

According to the classification of the informants, rich farmers around Dakar kept sheep (mainly a specific breed with an impressive size locally called *ladoum*) not for selling or own consumption but as a hobby and for prestige. The decision of this category of farmers to raise the *ladoum* has surely some commercial motivation. However, most of

them argued during visits to their farms, that sheep-keeping was more social than economic, in contrast to other farmers who fatten sheep for celebrations or as a reserve during hard times. Rich farmers of Dakar suburbs who generally have other income generating activities than livestock, are more interested in having the biggest and most beautiful animals in the area than in profit or food production. This contrasts with the objectives of poorer farmers from both regions whose production is mainly for market. Livestock keeping is their main activity and the sole source of income. They recognized that they were “selling sheep more than eating them...One prefers to sell these animals to buy fish” (FGD in Ngor, Dakar, June 2013).

3.2. Role of animal source foods in the diets of children

In both areas, ASF is gradually incorporated in the diet of children without an emphasis on any specific ASF. Irrespective of the location and the context, various foods are introduced at different stages of the child growth. Fruit juice from local fruits and millet porridge are used to supplement breastfeeding from around 6 months. Only at 10 months do most mothers start incorporating ASF to the diet of children. This comprises eggs, fish and milk but not flesh (beef, pork or mutton) as it is considered difficult to chew. In urban settings only, some women give yogurt (industrial or traditionally made from cow milk). Other practices were to give beef liver to children not yet able to chew, or to grind meat and gradually incorporate it into other cereal meals. In rural areas children consume food that is available such as eggs, cow and goat milk, and fish. When they are older (18 months), children consume well-cooked meat, cut into small pieces.

3.3. Perceptions, taboos, health and nutrition beliefs related to animal source foods

The ASF foods given to children were influenced by traditional beliefs around nutrition and health.

3.3.1. Nutritional beliefs

Some ASF are given to children because mothers are aware of nutritional properties. Mothers prefer to give boiled eggs to children, mainly the yolk, because they believe it contains vitamins. Women in rural areas could generally agree that egg, fish and milk were “good for the growth of the children”. Those from urban areas could clearly articulate why ASF was given to children. They spontaneously mentioned the content of these foods given to children in terms of iron, proteins and vitamins. Their preference for liver is due to its soft texture, and because it is believed to “enrich the child's blood” and help the child gain flesh. Some women could also define some foods they believe harmful for health such as fatty meat that contains cholesterol which will lead to high blood pressure. Other health consequences of the consumption of meat with fat mentioned in Dakar were vomiting and diarrhoea.

Regarding fish, women from Tambacounda region had limited experiences as their access to this resource is limited. However, those in urban areas mentioned that fish is healthier than meat. In Dakar, mothers report eating certain shellfish raw, as products from the sea are believed, if eaten raw, to provide vitamins, and “to eradicate diseases such as cancer”.

It is worth noting that in local beliefs, especially concerning children, the reference to vitamin is often linked to weight gain even in urban areas. When women mention foods that provide vitamins, the term is used to indicate the nutritional value of that food in general. The vitamin intake is then evaluated according to them by weight gain in children or ill persons.

3.3.2. Health beliefs

Several diseases and allergies are associated with the consumption of milk, irrespective of the setting. Milk consumption by children was

associated with diarrhoea. However, in rural areas diarrhoea was associated with other causes such as teething; some said that if children saw certain trees they could have diarrhoea the same colour as the trees (greenish). Contaminated meat was also seen as a cause of diarrhoea. More generally, some mothers, especially in rural areas, said they do not give goat meat to children because “*that animal hosts many diseases*”. Goat meat and milk was associated with various diseases in children such as dermatitis and rheumatism. Women also thought that animal intestines could make children sick. Mothers in urban areas believed the meat and milk from goats may be responsible for allergies in children (FGD in Guediawaye, Dakar, June 2013).

3.3.3. Cultural beliefs and taboos on animal ASF

In both study areas, people mentioned several food taboos. The consumption of some types of meat is restricted due to religious reasons (consumption of pork by Muslims) or because the meat is culturally considered as unsuitable for eating (donkey and dog meat). In the two investigated settings, there were several cultural beliefs and food restrictions involving the mother and child. Failing to respect the restriction could have health consequences. Some communities believed that “*a child who is not yet speaking should not consume eggs, otherwise, he or she will take a long time to speak articulated language*” (FGD in Guediawaye, Dakar, June 2013). Moreover, while women feed children with meat from the head of sheep, they avoid giving them the legs, because of a belief that if children eat the legs, they may become liars (FGD in Kothiyari, Tambacounda, July 2013). Some reported that if brains of animals are given to children their intelligence may be low. Also, people commonly believe that pregnant women should not eat the lungs and intestines of cattle and small ruminants as it may affect the growth of the child. For example, in Dakar it was said that if the mother ate tripe, the baby's head will have the shape of tripe. Moreover, there was a belief that if pregnant women eat a lot of meat they will bleed a lot during delivery. In urban Dakar, people believed that eating sea urchins could prevent tetanus.

However, the consequences of those taboos are increasingly nuanced especially in Dakar, where some reported that while they were aware of food taboos, these were no longer strictly respected due to their higher level of education and access to information.

3.4. Risk management related to foods of animal origin

Several risk management practices were followed including of washing, boiling, smoking or drying foods of animal origin are used by women from rural and urban settings. Women take precautions to eliminate “bugs” or potential pathogens that could make them sick. They are also aware of the basic rules of hygiene such washing food. In rural areas, milk was sieved and boiled before given to the children. When asked what they believed made meat safe for consumption, women from rural and urban areas unanimously cited cooking well. Frying fish was also cited as a strategy to reduce the risks. The meat from animals that were sick before being slaughtered was also not given to children as they are considered as more at risk of diseases than adults.

Women use modern and traditional methods of preserving ASF. The method of food preservation used depends on the financial capacity of the household. Some households have refrigerators and freezers and others use traditional methods. Several conservation techniques for meat, fish and milk used in rural and urban areas are summarised in the table below (Table 2).

It appears from discussion with women that salting and drying fish and meat extend the conservation period for several days and weeks. When meat is boiled or fried, it can be preserved for over two weeks. Dried fish may be stored for more than one year (FGD in Ngor, Dakar, June 2013). Women are aware of the risks of improper storage of food on health. During the discussions, they acknowledged that “*when it is dried, it does not spoil. When it is not well dried, it gets rotten*”. Moreover,

they recognized that the taste may change if the meat is preserved long before being consumed.

3.5. Health assessment of small ruminant herds

None of the samples was found to have antibodies against *B. melitensis* through either of the diagnostic tests used.

4. Discussion

Brucellosis is believed to be one of the most serious and widespread zoonotic diseases of small ruminants. Several studies have found moderate to high levels. For example, a survey done in Côte d'Ivoire in August, September, October 1990, December 1991 and February 1992 showed a sero-prevalence of 23.5% for brucellosis in sheep (Atse N'de, 1992). Another survey conducted in northern Côte d'Ivoire in livestock and humans between 2012 and 2014 found human seroprevalence for *Brucella* spp. was 5.3%. Rose Bengal Plate Test and the seroprevalence of *Brucella* spp. in cattle adjusted for clustering was 4.6% (Kanouté et al., 2017). The laboratory analysis conducted in our study did not find any animals with antibodies against *Brucella* spp. The sensitivity of the Rose Bengal and Complement Fixation Tests used were 89.6% and 82% respectively (as per manufacturer's indications), which are not very high. This means that a possibility exists that the tests may have missed between 11 and 18% of positive animals. Using both tests in parallel increases the likelihood of detecting positive animals, but we cannot rule out the existence of false negative samples. Nevertheless, the use of positive and negative control during analysis supports the reliability of our results. An important finding from our rapid research, is that while expert opinion and literature review would both suggest brucellosis is a high priority in these communities, yet epidemiological studies did not support this suggestion. Hence, the need for incorporating epidemiological surveys in food safety and nutrition assessments.

Our study found that ASF are important in the diets of rural and urban children. Milk, eggs, fish and liver are targeted towards younger infants. There is some evidence that access to ASF, especially milk, leads to earlier weaning (Chege et al., 2015). However, in our study mothers reported that they exclusively breastfed until the infant was six months as recommended (Kim et al., 2018). However, we cannot confirm the accuracy of these reports which may be susceptible to normative bias.

Worldwide, there are several food taboos or restrictions generally associated with various phases of the human life cycle. Many of those taboos are around consumption of food by pregnant women and children (Fessler, 2002; Meyer-Rochow, 2009). If observed, they could prevent adequate supply of essential nutrients to the most vulnerable groups of the rural population, with the highest demand of amino acids, minerals and vitamins (Guèye and Bessei, 1995). Functionalist explanations propose that taboos have a utilitarian basis (fostering sustainable resource use or avoiding disease) while symbolists explain taboos through the meanings associated with food. In the communities in our study, eating tripe was associated with babies having tripe-shaped heads and eating animal brains with having low intelligence: these are possibly symbolist. Conversely, intestines tend to be more contaminated than muscle meat so avoiding consumption of intestines could be risk mitigating. Listed food taboos were said to be declining especially in urban areas due to modern education and information. However, based on their study on taboos on poultry products in Senegal, Guèye and Bessei (1995) concluded that since the taboos are rooted in the local traditions it cannot be expected that their influence in rural areas will disappear within the near future. Food restrictions listed in this study, appear to us not to be deeply rooted in the culture of investigated communities. As such they might be more easily abandoned as they do contribute to maintain the identity of the group and create a feeling of “belonging” (Meyer-Rochow, 2009). This is in

Table 2
Summary of conservation techniques for animal source foods in Dakar and Tambacounda.

Animal source food	Description of conservation technique	Location
Meat	<ul style="list-style-type: none"> ● Boiling and adding salt ● Boiling until the water is completely evaporated ● Storing in the fridge ● Cooking and conserving in a bowl covered with a light cloth ● Frying the meat to conserve for several days ● Cooking and immersing in molten fat ● Cutting into small pieces, salting and drying ● Frying and spreading the meat on a flat surface 	Dakar and Tambacounda
Fish	<ul style="list-style-type: none"> ● Cooking with salty water ● Drying in the sun ● Salting, leaving 2 days, then cleaning and drying on the sun 	Dakar
Milk	<ul style="list-style-type: none"> ● Boiling the fresh milk ● Keeping fresh milk for about 3 days to make yoghurt for their own consumption with children 	Tambacounda

contrast to more core beliefs such as the avoidance of pork meat by Muslims.

Interestingly, some other beliefs of dubious utility can be attributed to the modern media: for example, that fatty food will increase cholesterol or fish is healthier than meat. This illustrates how emerging global middle classes may have rather convergent beliefs around health and nutrition. However, messages intended to reduce excessive meat consumption may be less appropriate in developing countries where much of the population are deficient in micro-nutrients and childhood stunting is a significant problem. In these contexts, consumption of animal source food among infants and pregnant women should often not be discouraged.

Our study showed that both populations showed good awareness of the health risks associated with ASF. Women used modern and traditional methods of preserving ASF: the traditional methods relying mainly on heating, salting and drying (Touzi and Merzaia-Blama, 2008). These practices increase food stability (that is access over time) but they may entail food safety risks, which are not well understood, because risks of traditionally prepared foods are under-researched.

This is the first study to report an integrated nutrition and food safety of ASF from communities in Senegal. Because the study relied on reported data it may be subject to normative bias, with participants saying what they thought outsiders would like to hear rather than what they actually did or believed. Also the survey did not collect quantitative information on diet or anthropometric surveys, so relations between beliefs and practices and nutrition and health outcomes are largely theoretical. The sero-survey of small ruminants was large, but the animals were not selected probabilistically making it difficult to draw conclusions about absence of brucellosis on a population level. Despite these drawbacks, the study offered new insights on ASF in two diverse communities, showing the importance of ASF in the diets of infants, identifying misconceptions that could be addressed by interventions, suggesting areas for further study (such as nutritional and food safety aspects of traditional food preservation) and illustrating food systems in transition in response to urbanization and greater availability of nutrition and health information.

5. Conclusions

In both rural and urban areas, some, but not all, ASF were considered appropriate for children. The consumption of ASF is influenced by traditional beliefs, beliefs around nutrition and beliefs around health. Some beliefs prohibited the consumption of certain parts of the animal by women and children, some messages from modern media (e.g. meat has unhealthy cholesterol) and surprising beliefs in urban areas for example, raw seafood to eradicate cancer and goat meat/milk to cause allergies could also reduce consumption of animal source food. Education and schooling of girls who will later become mothers could deconstruct these beliefs related to these taboos which would lead them

to give animal foods to their children beneficial to their health and well-being

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Declaration of interest

None.

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