SI (EMERGING ZOONOSES)

The influence of gender and group membership on food safety: the case of meat sellers in Bodija market, Ibadan, Nigeria

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Abstract We describe a study to assess the bacteriological quality and safety of meat in Bodija market in Ibadan and to investigate the influence of gender and group membership on food safety. Mixed methods were used to gather information on meat safety and related socioeconomic factors. These methods included a participatory urban appraisal, focus group discussions with eight butchers' associations, in depth discussions with six key informants, a questionnaire study of 269 meat sellers and a cross-sectional survey of meat quality (200 samples from ten associations). We found that slaughter, processing and sale of beef meat take place under unhygienic conditions. The activities involve both men and women, with some task differentiation by gender. Meat sold by association members is of unacceptable quality. However, some groups have consistently better quality meat and this is positively correlated with the proportion of women members. Women also have significantly better food safety practice than men, though there was no significant difference in their knowledge of and attitude towards food safety. Most meat sellers (85 %) reported being ill in the last 2 weeks and 47 % reported experiencing gastrointestinal illness. Eating beef, eating chicken, eating offal, consuming one's own products and belonging to a group with poor quality of meat were all strong and significant predictors of self-reported gastrointestinal illness. We include that gender and group membership influence meat quality and self-reported gastrointestinal illness and that butchers' associations are promising entry points for interventions to improve food safety.

Keywords Food safety · Gender · Group membership · Butchers · Nigeria

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Introduction

Worldwide, diarrhoea is the second biggest killer of children under 5 years of age, accounting for 1.3 million deaths a year (WHO 2008). Almost half of all the deaths under the age of 5 years occur in just five countries, one of which is Nigeria (MDG 2009). Humans and animals share many pathogens, and the majority of human diarrhoea cases are associated with zoonotic pathogens and/or animal source food. For example, in the USA, seven of the nine most important food-borne pathogens have an animal reservoir (Lynch et al. 2006). Hence improving the safety of animal-source food is a priority. Moreover, animal waste is a major source of contamination of water and crops also resulting in sickness from non-animal source foods and water

Urbanisation in developing countries is often considered a driver of higher levels of food-borne disease (Cole et al. 2008). High demand for livestock products coupled with poor infrastructure and lack of refrigerated transport leads to large numbers of animals being kept close to cities, often in unhygienic conditions. Compared to rural systems, food

chains are longer (increasing opportunities for bacterial growth) and are higher volume (increasing opportunities for cross-contamination). Consumers cannot easily observe activities along the value chain, removing a check on unhygienic practice.

While the poor food safety in urban markets has been often documented, there has been less research on the social factors that influence this. This paper reports on a study from Ibadan in Nigeria: its objectives were to understand the role of gender and collective action in the marketing of meat and to investigate relations between these and food safety.

Materials and methods

Study site

The study took place in Bodija market, the main market centre in Ibadan for livestock slaughter, processing and marketing. Ibadan is the capital of Oyo state in southern Nigeria. Data were collected between August 2008 and December 2009.

Sample selection

The study population was processors and retailers of beef in Bodija market. These are self-organised into occupational groups (butchers' associations), which were the unit of observation for the participatory and qualitative studies. For the participatory appraisal, we chose butchers' associations based on their willingness to participate and key informants who were considered able to contribute most usefully. For the quantitative study, we initially identified 16 associations in the market and then randomly selected 219 meat processors/retailers (205 men and 14 women) from the list of members. In order to obtain more information on women workers, we subsequently randomly selected an additional 50 women. This brought the total sample size to 269.

Data analysis methods

We used mixed methods for data collection. The qualitative methods consisted of focus group discussions (held with four women's groups and four men's groups) and six individual in-depth interviews with two sets of key informants: leaders of processing and marketing groups (four men, two women) and government officials (one man, four women). Interview guides were prepared. Participatory appraisal tools used in the qualitative studies included community mapping to show spatial features, Venn diagrams to illustrate social organisation patterns and problem tree analysis to allow groups to describe their perspectives regarding the causes and consequences of conditions.

The quantitative methods consisted of knowledge attitude and practice questionnaires combined with observation check lists. Knowledge was assessed through 18 questions about food safety; attitude was assessed through a 30-item Likert scale and practices through 12 questions about self-reported behaviour plus direct observation. Respondents were also asked about meat consumption and illness in the previous 2 weeks.

A cross-sectional survey was carried out to assess meat bacteriological quality and presence of certain food-borne zoonoses ($n=200$ meat samples). Because of resource limitations, 10 of the 16 butchers' associations originally identified were sampled. Standard bacteriological methods were used to assess total aerobic counts, *Enterobacteriaceae* counts and coliform counts. In addition, we investigated the presence of five important zoonoses (*Escherichia coli*, *Salmonella* spp., *Listeria monocytogenes*, *Staphylococcus aureus* and *Yersinia* spp.) and eight bacteria associated with environmental contamination which have also been associated with diarrhoea.

Statistical analysis

Comparisons between continuous variables used the cluster-adjusted t test, and between categorical variables, the cluster adjusted chi-square test. Intra-cluster correlations (ICC) were used to compare how similar members of a group were to each other as compared to non-members. Endemic diseases in animals typically have an ICC less than 0.1 (highly contagious epidemic diseases can have ICC of 0.3–0.4) (Otte and Gumm 1997). Given that food-borne pathogens and contaminants are not highly contagious, we considered an ICC of 0.1 or more evidence of similarity between members of a group sufficiently large to have practical implications. Univariate analysis was used to investigate the relation between putative risk factors and self-reported gastrointestinal illness in the past 2 weeks. Based on the univariate analysis and a causal diagram, we developed a logistic regression model to explore the relation between socioeconomic factors and gastrointestinal illness. We used casewise deletion in the case of incomplete data and robust standard errors with clustering on association. All statistical analyses were carried out using Stata® (StataCorp, TX).

Results

Response rates

At the start of the study, we were able to identify 16 butchers' associations; as the study progressed and trust was built with the people in the market, we discovered there were an additional six butchers' associations which had been unwilling to

be identified or to participate initially. Assuming from 20 to 60 members per group, this corresponds to around 800 to 900 butchers operating in the market. We obtained completed questionnaires and check lists from 262 participants (201 men and 61 women).

Characterisation of meat processing and selling in Bodija

Cattle, small ruminants and pigs are slaughtered, processed and sold at Bodija market. This study focused on cattle. Around 250–300 cattle are slaughtered daily; more are slaughtered on weekend days and fewer during Muslim holidays. Most butchers slaughter only one animal a day (participants estimate that 75–90 % of butchers fall in this category); butchers sell to retailers who have small kiosks in a different part of the market and sell directly to consumers (Fig. 1). More rarely, a household buys an entire carcass for a ceremony: this only happens on weekends. Retailers are also mostly small scale, typically buying a quarter of a carcass. A few have specialised by supplying boneless beef to hotels and fast-food establishments or to institutions such as the University College Hospital. Most butchers consider themselves poor: they say they do not have money to buy an animal for slaughtering and obtain it on credit.

As shown in the community map (Fig. 1), cattle are kept in pens then moved to the slaughter slab. They are tied down at the slab and killed by cutting the throat. The dead cattle are then dragged on the ground to the abattoir area. This is a shed with a concrete floor and open sides. Processing, that is removal of the intestines and quartering, is done on the floor. Portions of the carcass are then carried to the adjacent butchers' stalls where they are sold. All parts of the animal have potential uses: muscle meat and offal are sold for food. Bones are used to make bone meal for animal consumption as well as in the production of serving plates. The skin is used to make leather for bags, shoes and boxes and is also eaten. Horn is processed into buttons and decorations and can also be used for incantations and rituals. Hooves are

used in the manufacture of buttons, while the teeth are soaked in water and used for treating people who have problems with their own teeth. The bile is swallowed raw by people in the belief that it will strengthen them. Urine is used in treating convulsions in children. Blood is processed into blood meal used for animal feeds. Gut contents and faeces are used for fertiliser. However, for the last four by-products (urine, bile, faeces and gut contents), supply exceeds the demand and the greater part is piled as waste or allowed to run into gutters.

The abattoir is under municipal management and officers collect tax and tariffs on each cow amounting to $1 per animal. The role of environmental sanitary officers is to inspect slaughter slabs and the general environment and ensure the area is clean. However, the filthy conditions of the market witness the challenges they face in carrying out their work. The veterinary department is supposed to check animals before slaughtering and inspect meat after slaughter, but many animals escape inspection and even when problems are found veterinarians find it difficult to ensure that condemned meat is discarded. Most butchers kill only one animal a day, and if this is condemned by veterinarians as unfit for human consumption, butchers lose their entire days' earnings. Hence, they strongly resist attempts to condemn meat.

Social and gender aspects of processing and selling meat

The qualitative study allowed a broad characterization of how collective action and gender influenced work. The butchers' associations include not only the slaughterers who kill and section the animal but also cattle owners, marketers of live animals, those who bring the cattle to the slaughter slab, leg sellers, skin sellers, head sellers, offal sellers and meat sellers. The butchers' associations are self-organised and structured with executive members, regular meetings, registered names and linkages to other associations as well as to 'umbrella' organisations. Many of the associations have

Fig. 1 Bodija market: abattoir and meat selling areas
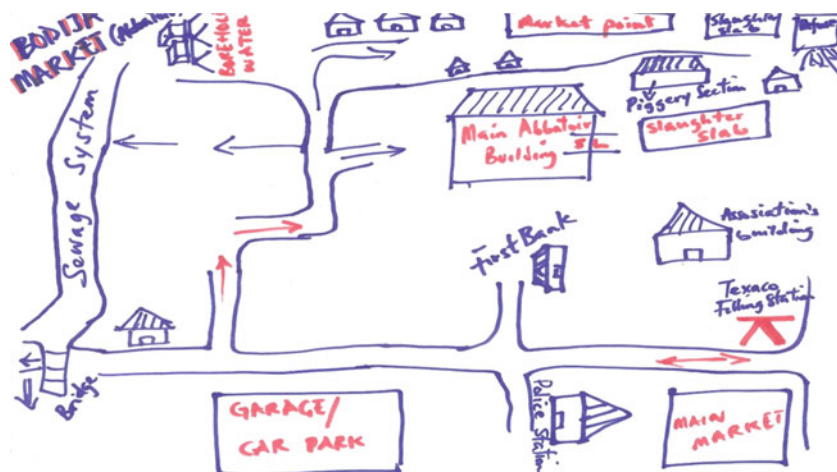
existed for over 25 years. Membership varies from around 20 to above 60. There are male only (*n*=6), female only (*n*=5) and mixed (*n*=8) butchers' associations (numbers refer to those associations willing to provide information on membership). Most of the activities of processing and sale can be carried out by men or women. However, slaughtering of cattle is an exclusively male role and fetching water an exclusively female activity.

The butchers' associations provide opportunities for apprenticeship, financial and social support and represent members in interactions with officials and other associations. They have rules and regulations, but these are essentially aimed at maintaining harmony among members rather than improving food quality or safety standard setting, e.g. "Members must not steal from each other and members must not take each other's wife, except after divorce."

The questionnaire survey added more details to this picture. There were fewer women meat retailers than men. Women did not differ significantly from men in ethnicity, religion, marital status, number of other sources of income or participation in secondary and tertiary education. Women were significantly older, more likely to have received no formal education and to be involved in trade (Table 1).

Women had been members of butchers' associations for an average of 16.2 years and men for 13.7 years: the difference was not significant. More men (22 %) than women (18 %) were committee members, a difference that was not significant. However, women were significantly more likely to regularly attend meetings than men were: 98 % of women attended regularly compared to 87 % of men (*p*=0.009). Women also belonged to significantly (*p*=0.02) fewer groups than men, 2.3 versus 2.9. Men were significantly and substantially more likely to belong to co-operative societies, informal work exchange groups and town unions. In the case of religious groups and informal savings groups, there were no differences between men and women. Women belonged to an average of 1.6 savings groups, significantly

more than men who belonged to 1.4 on average (*p*=0.03, ICC=0.011). However, male members of savings groups contributed significantly more money per week than women ($19.2 versus $11.2, *p*=0.005).

Social and gender determinants of meat quality

Most meat samples showed unacceptably high levels of aerobic bacteria, *Enterobacteriaceae* and/or coliforms (98 % of samples). Zoonotic pathogens were present in 67 % of samples and environmental contaminants in 46 %. Detailed bacteriological results are not considered in this paper and will be reported elsewhere.

The moderate to high ICC suggest that group members had greater similarity to members of the same group than to members of other groups in terms of quality (Table 2). This evidence of intra-group similarity allowed us to divide groups into 'better quality' and 'worse quality' based on differences in average bacterial counts. Meat samples were obtained from ten butchers' associations. We considered the five groups with highest TAC, *Enterobacteriaceae* and coliforms to be 'bottom-half' quality and the five with lowest to be 'top-half' quality. Moreover, although all had overall poor quality, two were considerably worse than others (considered 'worst quality') and two were considerably better (considered 'best quality').

A significantly higher percentage of men than women belonged to an association with bottom-half quality (73 versus 53 % respectively (*p*=0.028)). The effect was even stronger for associations with worst bacterial quality: these groups had 92 % male and 8 % female membership compared to 73 % male and 27 % female in other associations (*p*=0.007). Consistent with this, groups with the best bacterial quality were 59 % male and 41 % female versus 85 % male and 15 % female in non-belongers (*p*=0.001).

There was no significant difference between men and women with regard to knowledge of food safety and attitude towards food safety. However, women had significantly (*p*=0.03) better practice of food safety (Table 3).

Table 1 Sociodemographic characteristics of women and men butchers in Bodija market

	Women	Men	*p* value
Age	39 years	34 years	0.014
Muslim religion	84 %	91 %	ns
Yoruba ethnicity	98 %	97 %	ns
Single relationship status	19 %	11 %	ns
No formal education	38 %	10 %	0.000
Secondary education or above	7 %	8 %	ns
Other sources of income	35 %	34 %	ns
Involved in trade	28 %	16 %	0.04

ns not significant

Table 2 Intra-group similarity in the presence of different hazards found in meat sampled from butchers' associations in Bodija market, Ibadan

Hazard	Intra-cluster correlation coefficient (ICC)	Interpretation of ICC
Number of pathogens and contaminants	0.16	High
Total bacterial counts	0.09	Moderate to high
Enterobacteriaceae counts	0.06	Moderate
Coliform count	0.03	Low

Table 3 Hygienic practices of men and women butchers in Bodija market, Ibadan

Gender	Female (%)	Male (%)
Total good practice score	72.4	63.0
Equipment checked before use	93.7	82.5
Bones put in designated bin	93.7	85.4
Meat with bad odour not sold	93.7	78.2
Animal waste disposed properly	88.9	87.4
Equipment washed before use	87.3	84.0
Equipment washed after use	87.3	80.1
Floor is well drained	66.7	56.8
No eating or drinking	61.9	44.2
Floors have no cracks	57.1	46.1
No smoking	52.4	46.6
Gloves washed before use	42.9	30.6
Gloves washed after use	42.9	34.5

Self-reported illness among beef handlers

Ill health was very common among the meat handlers surveyed: 88 % reported illness in the last 2 weeks. Seventeen different problems were reported: the most common symptom was fever (79 %) followed by backache (69 %) and gastrointestinal symptoms (47 %, of which 30 % diarrhea and 17 % constipation and/or vomiting). The majority of those reporting illness (89 %) took medicine, suggesting most illnesses were non-trivial. Overall, there was no significant difference in reported illness between women and men (89 and 87 %, respectively, $p=0.749$). However, men were significantly more likely to report backache ($p=0.008$) and neck pain ($p=0.018$) and women significantly more likely to report anorexia ($p=0.021$) and vomiting (0.058, marginally significant).

We investigated meat consumption as a risk factor for self-reported gastrointestinal illness. Meat consumption was high: 97 % of people had eaten meat in the previous 2 weeks. Overall, 52 % of butchers consumed their own products while 42 % bought meat. The remainder either did not consume meat in the previous 2 weeks or received meat as a gift. Women were more likely to buy meat than men (30 versus 18 %) and less likely to eat their own wares (14 versus 33 %): these differences were significant at $p=0.019$ and $p<0.001$, respectively. Beef, offal and chicken were the meat most consumed. Women were significantly more likely to consume offal ($p=0.004$). They were also less likely to consume beef and chicken, although this was significant only at the 0.1 level (i.e. a 10 % likelihood, the results could have been significant through chance alone).

The logistic model constructed to investigate the relation between risk factors and self-reported gastrointestinal illness showed that eating beef was the strongest and most significant predictor of illness (Table 4). Belonging to a group with poor quality of meat, eating chicken, consuming one's products and eating offal were also strong and significant predictors of disease. Being male was protective; however, this effect was not significant when other confounding factors were taken into account.

People who belonged to groups with bottom-half quality meat were significantly more likely to have had signs of gastrointestinal illness in the last 2 weeks and to have sought treatment (see Table 5). These groups had 23 % additional illness compared to the groups with better quality of meat.

The qualitative study showed a fatalistic attitude towards illness. Focus group participants considered that they worked in an unhealthy environment but when asked what could be done to reduce the threat to their health, they responded that "Concerning diseases and illnesses, there is nothing we can do." The qualitative study also revealed additional risky practices; for example, although meat is usually well cooked before consumption, retailers were sometimes observed to cut a small piece of raw meat and eat it, in order to convince the customer of the safety of their product.

Discussion

Our study was consistent with many previous studies' finding that conditions in Nigerian abattoirs and meat markets are

Table 4 Logistic regression model showing association between individual characteristics and likelihood of reporting gastrointestinal illness among butchers in Bodija market, Ibadan

	Odds ratio	Robust standard error	$p > z$	95 % confidence	Interval
Consumed beef	9.18	4.13	0.00	3.80	22.16
Belonging to group with poor quality meat	3.38	1.68	0.01	1.27	8.96
Consumed chicken	2.03	0.53	0.01	1.22	3.39
Consumed own meat	2.76	1.15	0.02	1.22	6.25
Consumed offal	2.37	1.24	0.10	0.85	6.60
Male	0.78	0.79	0.81	0.11	5.72
Size household (HH)	0.90	0.09	0.31	0.74	1.10
Members HH sick	0.81	0.41	0.68	0.31	2.17

Table 5 Relation between the quality of meat sold by a group and the likelihood of members to report gastrointestinal illness and to seek treatment

| | Bottom-half quality meat | | | Top-half quality meat | | | | | |
Exposure	Total	Cases	AR%	Total	Cases	AR%	Risk	Ratio	p value
Report illness	73	58	79.45	79	47	59.49	1.34	1.08–1.66	0.008
Seek treatment	96	73	76.04	25	14	56	1.36	0.94–1.96	0.047

AR attributable risk

very poor (Adeyemo 2002; Cadmus et al. 2008). Food-borne infection is endemic in Nigeria. The 1997 Local Government Health System profile for Nigeria on leading causes of deaths in different zones showed that diarrhoeal cases accounted for 25 % followed by malaria (21 %) and accidents (10 %) (FAO/WHO 2002).

The level of self-reported disease from meat retailers in this study was very high. Studies from developing countries have estimated episodes of diarrhoea in adults from 0.5 to 2 per year (Walker and Black 2010). In our study, meat retailers have a rate of 7.9 episodes a year. The extremely unhygienic work conditions and the practice of eating unsold (and even raw) products may contribute to this high rate. This leads to the interesting conclusion that meat retailers may be a sentinel community for detecting food safety problems. Our questionnaire study covered 16 of the 22 butchers' associations ultimately identified, and as associations with lower quality are less likely to come forward, it is possible that the actual level of food-safety problems is even higher.

Our study found consuming animal foods was a risk factor for diarrhoea. This implies that in Bodija market, as in developed countries for which much more information is available, animal source foods are an important source of food-borne disease. In this study of beef retailers, consumption of beef was more strongly associated with illness than consumption of other meat, but this may reflect the practice of eating unsold meat. Consumption of offal was also associated with illness, which may be due to more rapid spoilage or difficulty in cleaning; other studies have also found offal consumption to be a risk factor for diarrhoea (Stafford et al. 2008). Women consumed more of the low-value offal than men; conversely, men consumed more high-value muscle meat. Preferential consumption by women was also the finding of a study on offal consumption in Somalia (FSNAU 2010). Differential access to more expensive food is common and has been implicated in lower nutritional status of women (WHO 2008). To our knowledge, this is the first time that differential access to food has been linked to a higher exposure to food-borne disease.

Our study found that women were involved in all aspects of beef processing and sale apart from slaughter of animals. An earlier study in Ibadan found a similar substantial involvement by women. However, a parallel study in Kaduna in northern Nigeria found much lower involvement of women (Olawoye 2006). In our study, women meat retailers were

quite similar to male meat retailers; their lower education was predictable.

Although women often have a key role in food processing, preparation and sale (Canet and N'diaye 1996), few previous studies have looked at how gender influences food safety among meat retailers. The finding that women had significantly better hygienic practice and groups with higher proportions of women had better quality meat was interesting. A study of food handlers in Malaysia also reported that women had significantly higher food-handling practice scores than men but there was no difference in knowledge scores (Nee and Sani 2011). Although little information is available from developing countries, studies elsewhere have shown than women are more concerned about food safety than men (Dosman et al. 2001). Moreover, the traditional role of women in Africa usually includes cleaning and food preparation: this experience may also contribute to better food-handling practice.

People belonging to the same butcher association had similar qualities of meat. This could be the result of the well-known social phenomenon of conformance with group norms; there might also be an element of self-selection whereby individuals with better practice join groups with better practice. The study also showed the importance of butchers' associations in establishing norms and in interacting with officials and other associations. This suggests that butchers' associations may be a conduit for improving food safety both through increasing access to information and by helping good practices take root and in lobbying for the infrastructure essential for hygienic meat processing and sale.

Previous food safety interventions have typically focused on municipal authorities and government officials. This study suggests that involvement of butchers' associations may be a useful complementary strategy in improving food safety. It was interesting that there were relatively few differences between men and women in their involvement with groups. Women's higher involvement in savings groups has been documented previously (Chowa 2006). African women are typically under-represented in government, parastatals and private companies (Losindilo et al. 2010): it was interesting that in these informal, self-organised associations, the proportion of women in leadership posts was no different from that of men. An important finding was the clear link established between food safety practices, food safety microbiological outcomes and level of self-reported gastrointestinal disease.

Conclusion

Self-organised groups play an important role in slaughtering, process and sale of meat in Bodija market in Ibadan, a major city of Nigeria. Women also have an important role in all aspects of processing and sale except for slaughtering, although men dominate most activities. There is a little difference between women's socioeconomic characteristics and group involvement compared that of men; however, they do have better hygienic practice and better hygienic outcomes in terms of meat safety. Environmental conditions in Bodija market were very poor and meat quality was low; however, some groups did obtain better quality meat and these also reported less illness. Important findings were that butchers' associations have an important role in the functioning of meat markets and group norms appeared to influence food safety. These findings imply that working with butchers' associations could be a promising entry point for improving the quality and safety of meat.

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