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1. Introduction

The pork tapeworm, *Taenia solium,* is an endemic parasite in pig-raising low- and middle-income countries of Africa (Phiri et al., 2003), the Americas (Flisser et al., 2003) and Asia (Rajshekhar et al., 2003). It causes three different diseases in humans and pigs, being transmitted from pigs to humans causing taeniosis, from human to human causing (neuro)cysticercosis, and from humans to pigs causing porcine cysticercosis (Flisser et al., 2003). It mainly affects the health of rural smallholder farmers in subsistence farming communities (Braae et al., 2016). The diseases also reduce the market value of pigs and pork, compromising the livelihood of farmers (Braae et al., 2015; Trevisan et al., 2017). Cysticercosis is caused by ingesting *T. solium* eggs shed in the faeces of a human tapeworm carrier, whereas taeniosis is caused by ingesting the larval stage (cysticerci) of the parasite in raw or undercooked meat. The thorough cooking of pork kills the parasite and thus makes the meat safe for consumption (Møller et al., 2020). If ingesting infected pork, the consumer risks acquiring taeniosis and transmitting the disease to others in their community. Thys et al. (2016) found that in Zambia infected meat often is sold, albeit at a reduced price, echoing the results of Ngowi et al. (2008).

Previous studies have shown that *T. solium* health education of farmers and consumers can result in knowledge uptake (Ertel et al., 2016; Hobbs et al., 2018). Work by Sarti et al. (1997), Ngowi et al. (2008), and Ngowi et al. (2011) demonstrated that knowledge increased following *T. solium* health education, yet no significant change in behaviour was recorded in these studies. This shows that there is a need to address the gap between knowledge and action – or "implementation gap" (Dopson & Fitzgerald, 2005, chapter 3) in the behavioural change.

Shepperd et al. (2000) found that risk perception tends to become higher (meaning more pessimistic) when a threat is imminent, and if a threat to health is regarded as out of control, or if the health threat is very feared, the risk perception also increases (Slovic, 1987). Therefore, there is a need to identify what is perceived as dangerous, and how people perceive and evaluate risk of transmission in relation to buying, cooking, and eating pork, and how this informs the inherent practices. Fear and danger are socio-cultural constructs (Douglas, 1992) and thus an understanding of the cultural context is inevitable in order to understand how people analyse and navigate risk in their daily life.

According to The Society for Risk Analysis, each risk author needs to define the concept of risk in his own way and describe this definition clearly (Kaplan, 1997). The term *risk evaluation* is here used to define

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what the estimated risk means to people concerned with or affected by the risk. Therefore, it shares characteristics with risk assessment, but to distinguish it from risk assessment theory with its five phases of risk management (Champion, 2000), and to make it more dynamic and inductive, we have chosen the term *evaluation*. Risk evaluation therefore contributes to the wider objective of risk management and can consist of several activities: hazard identification, system analysis, consequence analysis, and maybe even event frequency analysis. In essence, risk evaluation is how you determine the severity of potential risks and how this informs your practice.

Douglas and Wildavsky (1983) found that the perception of risk is constructed collectively along with the accepted levels of risk. The idea that risk evaluation is a cultural phenomenon has since been widely accepted. Thus, the inclusion of how people talk about and practice risk evaluation is of great importance in the understanding of how people navigate risk in their daily lives. Furthermore, Møller et al. (2022) demonstrated that the context of daily life is necessary to include in transmission studies to enhance the cultural understanding of the risk of transmission, a finding similar to Zinn's (Zinn, 2005).

Based on an ethnography of practices related to buying, cooking, and eating pork in rural kitchens, this study aims at exploring the local practices of evaluation and perception of risk in relation to *T. solium* taeniosis. Through observations and individual guided interviews, applying the interpretivist-constructivist paradigm (Schwandt, 1994), the study aimed at understanding the risk evaluation practices through a case study of pork cooks (Stake, 1995).

Furthermore, the study sought to identify how professional cooks and women cooking at home evaluate risk in situations of buying, cooking and consuming pork, and to determine what contextual factors contribute when the risks in relation to *T. solium* and the transmission of taeniosis is evaluated or ignored.

2. Theoretical concepts

The main theoretical concepts used in this study are culture, knowing in practice, and risk. These are unfolded below.

2.1. Culture

Culture is understood as a social system for producing and maintaining meaning (Geertz, 1973). In this system, socially accepted cultural values guide people's behaviour in their day-to-day life. Thus, cultural values both guide practices and are reproduced and maintained through the practices in a given social system (Schatzki, 2002). This means that "culture is something to be understood in the context of action, actors and place" (Spradley, 1980) and is "*the acquired knowledge people use to interpret experience and generate behavior.*" (Spradley, 1980, p. 6, italics original). In this study, risk evaluations shape the cooking practices within the social system through which meaning concerning food is produced and maintained.

2.2. Knowing and learning is practice-based

The study draws also on the practice based approaches to knowing and learning (Lave & Wenger, 1991). According to Lave (1991), learning what to do and how to do it, i.e. the knowledgeable skill, is a social phenomenon rooted in the experienced world, where the Community of Practice (CoP) forms the base of this learning. In the CoP, the knowledgeable skillset is passed from old-timers (people knowledgeable within the skill in question) to newcomers (people new to the skill in question) through participation in the practice of this skill (Lave & Wenger, 1991).

The CoP in this research study consisted of rural Tanzanian cooks. Traditionally, people learn how to cook from their family members: women from their mothers, aunts, and grandmothers (almost exclusively from female to female). The restaurant cooks also learn from their friends or relatives, who themselves were restaurant cooks. Both home and restaurant cooks in turn teach their children and/or their friends the same ways of cooking that they themselves were taught. This is the "old-timer to newcomer"-passing of skill that is central to the concept of the CoP.

The cooking practices are thus maintained, develop over time, and are passed on to new generations. Knowing and learning are communal and relational activities that help stabilise the CoP and:

> "*knowledge and learning cannot be conceived as mental processes residing in members' heads; rather, they must be viewed as forms of social expertise, that is, as knowledge in action situated in the historical, social, and cultural context in which it arises and is embodied in a variety of forms and media.*" (Nicolini et al., 2003, p. 3, p. 3)

This approach to knowing is well-suited to explore risk evaluation as embedded into the practices of pork cooks.

2.3. Risk

The concept of risk has traditionally been defined as "an objective concept relating to the management of future uncertainties through rational action based on calculations of probability" (Zinn, 2005). In this study, however, we defined risk as a "situation or event where something of human value (including humans themselves) has been put at stake and where the outcome is uncertain" (Rosa, 1998), excluding therefore the evaluation of numerical probability but still accounting for something of value at stake with undetermined consequences following.

Douglas (1992) argued in her essays "Risk and Blame" that the understanding and perception of risk is socially constructed and under heavy influence by social institutions, values, and belief systems. She argues that a person's reaction to risks cannot be explained by that person's traits, needs, or preferences, but by their beliefs and values constructed within their cultural context. This is echoed by Douglas and Wildavsky (1983) defining risk as "culturally contingent, framed by context and arising out of culture". Therefore, trust in people selling food, in the markets, in the government, or in people giving food safety advice is a major factor in the food safety risk perception of people, which is in line with Nardi et al. (2020) and Brown et al. (2022).

2.3.1. Risk communication

The way we communicate risk to other people has historically been to convey the pros and cons of a particular action or the statistical chance of a certain event to take place (Bettinghaus, 1986). The traditional way of understanding risk assumes that if the person receiving the message has not embedded it into their actions, there is a tendency to examine the ways to better communicate those risks (Alaszewski, 2005b) instead of examining the particular context and the understanding of risk within the context. In essence, if the recipients of the information do not change their behaviour according to the information, we repeat it in a different way. However, as (Alaszewski, 2005a) argued, people are not rational when it comes to risk evaluation, and therefore it does not make sense to repeat the information about a given risk.

A person's reaction to a piece of information is "shaped by social context, their own needs for personal security and the extent to which they trust the source of specific items of information" (Alaszewski, 2005b). This means, that if health workers and experts, or health policy makers communicate along lines of rationality, numbers or statistics, the recipient of this information needs to be able to accept the same rationale as the informant and to agree to their sense of rationality in general. The recipients of the information need to be able to understand numbers and statistics to be able to incorporate the information into their risk evaluation. Even if these prerogatives are in place, knowing something is risky does not necessarily entail a protective behavioural change (Cattaruzza & West, 2013).

3. Study design and methods

This research project was designed as a case study with four embedded cases focusing on risk evaluation. Analytically, the cases were the four villages and empirically and the practices of risk evaluation were the units of analysis. It was carried out as an ethnographic research project with a 5-month (July–November 2018) fieldwork period in four rural villages of Mbeya Region in the Southern Highlands of Tanzania. The ethnographic methods used were in-depth thematic probing interviews guided by an interview guide with questions on risk evaluation, and risk management, as well as observations and participatory observations focusing on buying, cooking pork, and eating pork as well as the risk evaluation practices surrounding these events. The triangulation of data allowed us to explore the risk evaluation practices and to strengthen the findings.

3.1. Selection of villages and study participants

The four study villages as well as informants were chosen purposively. All villages and informants met the inclusion criteria (willingness to participate by both village leadership and informants as well as consumption and selling of pork (by informants and within the village, respectively)). All villages were accessible all year and located within 4 h drive from Mbeya City and had not previously engaged in *T. solium* research. The four villages were anonymously named based on topographic or landmark characteristics: Peak Village, Mountain Village, Factory Village, and Lowland Village (for details on sampling and inclusion criteria, see Anonymous (2022)). The latter was chosen to be the focus village based on its year-round accessibility by car, the great willingness to participate in cooking observations by home and restaurant cooks, and the presence of multiple pork restaurants as well as a local slaughter slab. This was where all the home cooking observations and most of the restaurant cooking observations took place.

The cooks were enrolled in the study using a gatekeeper in each of the villages. This was either the village chief or someone who knew the inhabitants in the village. The cooks were enrolled in the study based on both purposive and snowball sampling (Bryman, 2012). They were divided into two groups – home cooks cooking for the family (all female) and restaurant cooks cooking on a commercial scale. The home cooks were divided into younger home cooks between 18 and 39 years old and older home cooks of 40 years and above. This division of cooks allowed us to identify major differences in cooking practices between the groups, and between younger and older home cooks, if any. For details of inclusion criteria and enrollment, see Anonymous (2022).

3.2. Context of the study

Mbeya Region covers an area of 35,954 km^2 (URT, 2022) and has a subtropical climate with an average temperature of 16 °C. The region has a dry and a rainy season, with the rainy season lasting from November to May. The region is situated in the Southern Highlands, formed by the Rift Valley Mountain Range and ranging in altitudes between 900 and 2750 m above sea level (URT, 2022). The region has 2,3 million inhabitants (National Bureau of National Bureau Of Statistics, 2022), an increase from 1,7 million in 2012 (National Bureau of National Bureau Of Statistics, 2012). Pig farming has increased substantially in this area in recent years (URT, 2022), probably due to the high turnover rate and low feeding costs of the animals compared to cattle as observed in Zambia (Thys et al., 2016). More than half of the pigs in the country are farmed in the Southern Highlands (National Bureau of National Bureau Of Statistics, 2012) and there is a relatively high prevalence of *T. solium* taeniosis in this region (4,1%) (Braae et al., 2015). The inhabitants predominantly practice Christianity.

The study villages were low-resource subsistence farming communities with limited access to clean water, electricity, and sanitation. The houses in the villages were constructed of mud bricks with thatched or metal plated roofs on a small piece of land with crops, usually maize, beans, potatoes, and leafy greens surrounding most of the houses. Many families rented plots of land outside the village for additional farming of crops to sustain the family all year round. The majority of households kept chickens, and some kept a few heads of small livestock such as goats or pigs. In all four villages, pigs were observed roaming freely, foraging for food amongst the houses. Pigs are regarded as practical animals that are easy to keep, as they search their food and water themselves, and furthermore function as cleaners of the surrounding environment (Ngowi et al., 2017). In the study villages, most houses had their own latrines. All villages had a communal latrine, but despite this most villagers reported using the environment or their own latrine, if at home. Not all latrines were protected from the free-roaming pigs, as most only had doors made from plastic bag material or cloth. Therefore, pigs can get into contact with human waste, including human faecal matter deposited in nature, facilitating the life cycle of *T. solium*.

3.3. Data generation: interviews and observations

In this study, the data was generated rather than collected, meaning that the researchers organise a set of situations that will "produce rich and meaningful data for further analysis. Data generation comprises activities such as searching for, focusing on, noting, selecting, extracting, and capturing data" (Goldkuhl, 2019). The situations organised in this study consisted of 64 interviews with restaurant and home pork cooks as well as 14 observations (Table 1) in order to explore ways cooks perceived risk regarding *T. solium* taeniosis.

The interviews were guided with emphasis on the cooks' own experiences and reflections about the cooking and consumption of pork, and their attitude towards pork eating habits. The interviews took place in the restaurants or homes of the cooks, and, in a few cases, at a village gathering point, when the cooks lived far away.

The interviews were translated by a female native Kiswahili speaker, who also spoke fluent English. She was from the study district, was trained in translation before conducting the interviews, and translated questions and answers within interviews and, when needed, during informal talks. A few of the cooks did not speak Kiswahili, and in such cases, we used a second female translator known to the informant, who translated from tribal language to Kiswahili. The interviews were audio-recorded (with the exception of two interviews due to technical issues), and handwritten notes were taken during each interview by the researcher, who was also the interviewer. Demographic data was collected and kept in Epicollect5, an app-based epidemiological survey tool, and entered prior to each interview. All cooks were given a code name according to village, informant group, and consecutive number, e.g. Low-MC-03 being Lowland Village, male restaurant cook, number 3). The interviews followed an interview guide and were semi-structured in nature and included questions of basic demographic data but focused mainly on the informants' preferences when buying pork, their personal cooking recipes, the history of their cooking, and their views and opinions of the pork cooking, as well as the trading, handling, and eating of pork. This interviewing method, along with on-site observations, allowed for the context of the informant and their everyday life to emerge, which is of great importance when aiming at understanding how actions and experiences are joined together in everyday risk evaluation (Zinn, 2005).

Observations with the restaurant cooks took place in their respective restaurants and included informal small talk with the cook and customers. The restaurants were typically most busy at lunchtime, but stayed open until the pork had sold out. At each observation, we spent from 1 to 4 h at a restaurant, observed the interactions with customers, listened to the stories, and shared small meals with regular customers, when offered. This allowed us to gather descriptions of everyday life at a pork restaurant, the preferences that villagers had when buying pork at restaurants and why, as well as the cooks' decisions and choices regarding cooking and serving pork.

Table 1
Interview and observation data from fieldwork (adapted from (Anonymous, 2022)).

Village descriptor	Interviews				Total	Observations				Total
	Restaurant cooks		Home cooks (all female)			Restaurant cooks		Home cooks (all female)		
	Male	Female	18–39 years	≥40 years		Male	Female	18–39 years	≥40 years	
Lowland	3	1	6	6	16	3	1	2	3	9
Peak	1	0	6	6	13	0	0	0	0	0
Mountain	4	0	7	6	17	0	0	0	0	0
Factory	1	4	7	6	18	1	4	0	0	5
Total	9	5	26	24	64	4	5	2	3	14

Participatory observations with home cooks took place at cooking sessions in their respective homes. The observation notes, including sketches of the kitchen, the cooking area, tools, village topography, and other potentially interesting points were handwritten in field journals and entered into a computer at the end of a workday. The focus of the observations and thus the resulting field notes were the practices of cooking pork, as well as how the cooks would buy, prepare, and cook the pork, the eating situation, and how the situation of selling would take place in the restaurants.

Furthermore, we took photos of the area and of the villages to aid in keeping the fieldwork alive during data analysis. We obtained written consent from all participants. In case of illiteracy, the informant was read the consent form in the presence of a witness, who signed for them. The informant signed the consent form using a thumbprint.

After finishing the 64 interviews, Lowland Village was chosen as focus village of the study, where all the home observations would take place because villagers there were very eager to share their stories and have us accompany them. They were very welcoming and included us in a natural way into their homes and cooking practices. Furthermore, walking around in the village between formal observations, visiting previously interviewed people, allowed us to develop a deep understanding of village life, interactions, and the relationships that formed the village's social structure. Furthermore, Lowland Village was estimated to be quite representative of a typical village in the Southern Highlands of Tanzania in terms of socio-economic status, location (distance to city, hospital, and other typically urban amenities), and pork eating inclinations.

3.4. Data analysis

The data were analysed case-by-case inductively, compiling the data into the qualitative data analysis program Nvivo 12. Data consisted of field notes from observations and informal talks, as well as transcribed and translated interviews from audio-recordings.

The analysis of the data occurred in two rounds of coding during which the themes of "Transmission", "Embedded in practice" and "What is risk?" were identified producing first and second order codes, and finally analysed into thematic findings such as "Risk perception" and "Practices of risk evaluation".

The analysis was aided by photos, hand sketched illustrations and rough maps from the village visits.

4. Findings

4.1. Ethnographical data of three situations of interest

The three situations of interest to this study were the buying situation, the preparing and cooking situation, and the eating situation. Therefore, the following section is a context description of the three situations in the two main groups of cooks in Lowland Village – the home cooks and the restaurant cooks.

The houses in Lowland Village did not have running water or sewage systems. Water was fetched in the river or from the communal tap. All had indoor cooking areas with dirt floors but no refrigerators, freezers, kitchen tables, shelves, cupboards, nor stoves (see Fig. 1). The most common cooking method of pork was frying in a bit of oil with vegetables and served with *ugali*, a common maize porridge. Preparing and cooking the food was done sitting on low stools. The cooking area consisted of three larger rocks lined up against each other (see Fig. 1). The home cooks kept the fire below and the pots above, perched on the rocks.

By pushing the firewood into, or pulling it out of, the middle of the rocks, the home cook could control the heat.

Cutting of vegetables was done in hand without a base to cut on. Cutting of meat was done by two people, one holding the meat and one cutting off chunks. The home cooks used the same knife to cut all the ingredients, but in some observations wiped it in an apron cloth in-between cutting different ingredients.

The meal was eaten at the sofa table in the living room (Fig. 2). All the participatory observation meals were eaten indoor in the living room sofa area. Traditionally, the father of the household would eat the bigger and better pieces of meat and the children the smaller pieces. Often the children would share a plate of food on the floor next to the table, in the kitchen area, or outdoor, but the adults would have each their own plate. The mother would usually eat whatever was left, often directly from the pot.

A restaurant was usually situated by the village square, and was a single room built of wooden planks or mud bricks. There were other small shops there as well, selling food or household items, providing mobile phone charge, or selling locally brewed alcohol in a bar setting. There was always a bar close to restaurants.

The slaughtering of the pigs took place on the outskirts of the village on locally built concrete slaughter slabs (except in Factory Village, where slaughtering took place at the nearby municipal slaughterhouse). In Lowland Village, the slaughter slab was situated just off the village square and was built as a joint investment between the restaurant cooks

Fig. 1. Typical cooking area in the kitchen of a home cook: The formation of the typical firewood stove comprised of three leaning stones.

Fig. 2. Typical living room of a home cook: The home cook (left) seated for interview with the translator (right).

and the bar owners in the village (see Fig. 3) as they shared the same customer base.

At the restaurants, the kitchens were situated at the end of the restaurant room itself and thus open to customers. The cook usually worked alone in the restaurant, but sometimes a young person helped with serving customers, thus learning the trade. The cooking area was similar to the one in the home kitchens, although sometimes formed in cement as well as rocks.

Fig. 3. Lowland Village slaughter slab: A restaurant cook is cleaning out a newly slaughtered pig together with two helpers.

There was always a table in the kitchen area, where the cook kept the meat on display, and prepared the meat for cooking. The restaurant cooks always cut the meat directly on the table, with visible cutting marks evident on the table surface (see Fig. 4, middle picture). The meat could be purchased in three different forms: raw, dipped in hot oil to remove visible blood, or cooked as a ready meal. The latter was very popular in the peak business hours during lunchtime. Most of the eat-in customers were men; women typically bought the meat to take it home for cooking.

The restaurant cook would take the order from the customer and prepare the meat accordingly. The customers would disclose any preferences in cooking. The food was served on metal or plastic plates alongside fried plantains, fresh chili, and lime. Before the meal, the customer would always clean their hands with soap and (sometimes hot) water provided at the restaurant. After the meal, the cook (or the helper) would clean the plate in cold water, and it would be ready for the next customer. The hot water was reserved for the customers' hand hygiene. Customers and cooks would always engage in conversations, tell stories, and share news on village life.

4.2. *Risk evaluation contains two dimensions*

The findings of this study show that risk evaluation is situated in the practices of buying, cooking, and consuming pork. We found that the practice of risk evaluation contained two dimensions: a theoretical and an experienced one. The theoretical risk evaluation deals with the knowledge that the cooks *have* and is thus inactive, whereas the experienced risk evaluation deals with what the cooks *do* in the lived everyday situations and is thus active.

During interviews, informants articulated some level of awareness of

Fig. 4a. A typical restaurant stove in a Lowland Village restaurant. The raw and cooked pork is chopped up on the tree stump using the large knife.

Fig. 4b. A typical restaurant cooking area in Lowland Village. Note the cutting area (the table itself) used for both raw and cooked pork.

Fig. 4c. A typical Lowland Village restaurant with cooking area in the back (with stove on the left) and seating area in the foreground.

the cysts of *T. solium* in pork (see Anonymous (2022) for details). All but eight pork cooks of the 64 cooks interviewed in the study knew that there could be "white nodules" in the meat and that this theoretically was associated with risk ("white nodules" was the term for *T. solium* cysts translated from the Kiswahili or tribal language words that the cooks used during interviews and informal talks in the villages). Many of the cooks had notions of what the white nodules could be, ranging from some correct knowledge - a worm that could make people sick -, to merely a pig disease with no (or few and minor) implications to human health. The latter concept was quite widespread throughout all four villages. This knowledge came primarily from previous education by local veterinary or human health personnel. The cooks could articulate the knowledge and easily describe it, yet the risk associated with it was theoretically perceived and did not consistently translate into an embedded risk avoiding behaviour. Indeed, the majority of the cooks were aware of the risk associated with eating white noduled pork, and knew that cooking the meat well reduced this risk. However, when triangulating the interview data with observations and informal talks, it became evident that the cooks' theoretical knowledge was often not embedded in their everyday practices of buying, cooking, and eating pork.

The field studies revealed what we have termed experienced risk evaluation. This dimension involved the evaluation of risk of buying or consuming pork in a *specific* situation, for a particular individual, at a particular time. This risk evaluation based on experience was difficult for the informants to articulate, as it was deeply embedded into the everyday practices of buying, cooking, or consuming meat. When asked about the risk, dangers, or negative potential outcomes associated with a particular practice, the cooks answered by drawing on their theoretical risk evaluation framework. Yet, during informal talk while participating in the meat handling activities, we observed that they would generally act according to their experienced risk evaluation, and do what made sense in that particular situation, regardless of the theoretically associated risk. In daily life, the experienced risk guided actions and practices, and was 'elastic' to suit the changing circumstances, resource availabilities and other challenges the informants had to navigate. For example, if meat without white nodules and resources to buy it were available, informants would not opt to buy the white noduled meat. However, if there were scarcity in finances and/or only the cheap, noduled meat was available, it would then be preferred over not eating meat at all. As economic resources were typically scarce, the evaluation practices would compete with other urgencies and most often, the buyer would buy whatever was available.

4.3. Risk evaluation in buying pork

When home cooks came to buy pork at the restaurant, which often functioned as the main meat purchasing place, they would choose the meat based on certain features that they preferred. These could be colour or texture of the meat, the presence of bones or not, the smell in the restaurant or the size of the pig slaughtered. None of the cooks mentioned looking for the *T. solium* cysts particularly, but the majority would express knowing that the presence was undesirable (for details, see Anonymous (2022)). Cooks would evaluate the risk of certain types of pork and include features of the meat that they deemed to be acceptable or not acceptable on that particular day. Interestingly, these features were idiosyncratic and would change considerably from home cook to home cook. Some would even change based on what the cook was cooking at that particular time, or for whom.

Home cooks had learned how to choose the meat from their mothers, and the variations of what was preferred were discussed as they bought pork at the local restaurant. The colour of the pork was very often discussed during the interviews. Whether the pork was of a darker or lighter colour was connected to (different) attributes that the women had learned to pay attention to. Some women preferred the white pork for different (often unspecific) health reasons, as this older woman:

> "Red meat is not good for you, white meat is better. I only buy white meat." Fac-OW-02

Other cooks had the opposite opinions and preferred the red meat:

> "I prefer the red and pink, not white. White meat means that the pig didn't eat well and it will smell bad [when cooking]". Fac-FC-03

Several cooks found that too much or too little colour of the meat

meant that the pig had been slaughtered when sick, which also held a risk:

> "[I do not like] Too red or too too white, because the pig was sick." *[sic]* Low-YW-03

These aspects of risk evaluation when buying pork were not systematic across the villages nor the different age groups. It seemed to be idiosyncrasies originating in general knowledge, but also combined with learned or perceived experience. Some home cooks could not explain how they evaluated the pork. When asked, an older woman explained:

> "I just know when the meat is nice. Then I buy it. I don't know how I know". Moun-OW-01

This excerpt shows the embeddedness of risk evaluation in her choice and how it is difficult to explain the reason for her actions: She has bought meat so many times that the reasons why have become embedded into the practice of buying pork.

None of the home cooks mentioned white nodules as a parameter for choosing meat, nor did they mention choosing pork based on knowledge of a parasite or any specific disease. Only when asked particularly about the white nodules did they mention the undesirability of them in pork. It seemed that the white nodules of *T. solium* did not play any part in their risk evaluation when buying pork at the restaurant.

4.3.1. Meat in buckets

Several of the home cooks would tell stories about meat sold in buckets in the street and disclose that they perceived this as risky meat. Women or men would walk from house to house selling meat from a plastic bucket with a lid. It could be any kind of meat, but it was often pork. The common trait of bucket meat was that it had not passed the inspection done by the local veterinary health inspector or the restaurant cooks themselves, and thus had to be sold outside the official channels.

As a younger woman described it:

> "If you try to sell the meat with the white bugs at the market, they will chase you away from the market. So some people sell the meat secretly and in hiding. They come to your house and you can buy it from the house." Moun-YW-03

Why the meat did not pass the inspection was not known to the home cooks, nor was it of any interest. The essence was that it was not good meat. As an older woman put it: "Meat in a bucket, [then] you know there is a problem" (Low-FC-02).

The door-to-door selling of meat was hidden in plain sight. In a nearby village (not a study village), a woman was witnessed selling meat in a bucket, calling it *"mchicha"*, meaning spinach. The villagers knew that this particular woman was not selling vegetables, but illegal pork. She would walk around with the covered bucket perched on her head, indiscreetly yelling *"mchicha"* in the streets to attract customers. This shows the commonality of the illegal selling and thus served as a testament proving that there is a customer base for this.

Interestingly, several women explained in their interviews how they themselves had never bought the meat in buckets, but most knew someone who had. It was by no means a foreign concept to the cooks. A restaurant cook even explained how the owner of a *T. solium* infected pig and the buyer of the pig had to come up with an agreement that they could both accept, which involved "selling the meat in a different way than in the restaurants" (Moun-MC-02) to make sure the money was not lost, meaning door-to-door selling in buckets.

When asked, one informant told during her interview that she had never bought pork with white nodules in it. However, after the interview she changed her story. The field notes from this day noted:

"[Name] tells us on the walk back to our car that she sometimes has bought *mbuzi katoliki* [literally Catholic goat, generally meaning pork] in a bucket. Sometimes her husband wants her to cook *kitimoto* [a local pork dish] but only gives her little money (he is at the bar drinking *pombe* [maize alcohol]) and she knows he will be angry and hit her if she doesn't cook enough. So the only meat she can buy in large enough quantities with that little money, is the *mbuzi katoliko* meat in a bucket. She laughs a little when she tells it, seems like she is shy to tell us. It seems like it is a bit embarrassing to her, and she doesn't want to talk about it in detail." Field notes, Lowland Village, 28/7 2018.

This is an example of the two dimensions of the risk evaluation. When she, during her interview, answered that she did not buy pork with cysts, her theoretical knowledge and risk perception prompted her to articulate the 'right' answer according to her awareness of risk evaluation. She theoretically knew that the meat was of lower quality and potentially harmful. However, when talking informally, she described how she evaluated the risk of her husband beating her, an experienced, embedded risk that outweighed the potential risk she was theoretically aware of as associated with buying and cooking the meat in bucket. For her, in this situation, the repercussions of not buying the infected meat far outweighed the potential dangers.

4.4. Risk evaluation in cooking and eating pork

Cooking pork took place in the home kitchens and in restaurants. The home cooks would cook pork for their families based upon availability and resources available. Often, meals did not contain meat of any kind but consisted of *ugali* (the local maize stable), beans, and maybe spinach from the household's farm plot. When cooking pork at home, the women used perceptions of texture, colour and smell to determine if the pork had cooked enough and was safe for consumption (see Anonymous (2022) for detailed descriptions). Generally, home cooks knew about the undesirability of undercooked pork, but they would also have to weigh it up against the fact that when frying pork thoroughly, it became hard to chew for babies and people with teeth problems. This balance required the analysis of risk associated with serving the pork undercooked, against the risk of cooking something that not all family members could eat. In general, it was very difficult for the home cooks to explain and articulate how much was *enough* when cooking pork.

> "(…) we don't look at the time it takes, we just estimate that here, now, it might be ready." Low-OW-02

Again, it was very difficult for both home and restaurant cooks to describe when the pork was ready. Many home cooks would fry the pork pieces in its own fat and a bit of water - whatever water was retained on the meat after washing it to remove dust and bone fragments. When this method was used, "readiness" was defined as when the water had evaporated. This undefined time measuring was noted by 17 of 50 interviews with home cooks.

Furthermore, field notes describes this situation:

> "We wait for the food to be finished. There is liquid in the pot from the washing water, from the meat itself and from the lemon, and this liquid has to go away. When she is very hungry, she will cook on the firewood stove – here the liquid dries much faster and then the dish will be finished sooner." – Lowland Village, Low-YW-02, cooking session

These examples show how the practice of deciding when pork is ready to be eaten is balanced against the needs of those who consume it and the particularities in a specific situation, more than a particular health risk. Risk has many words in Kiswahili, but none of them covers the English word *risk* (Desmond, 2015). The concept of risk and risk evaluation are theoretical constructs that none of the cooks in this study referred to or used. None of the interviewees mentioned nor explained analysing or evaluating risk in any form when cooking or handling pork. They did not *think* or *articulate* risk evaluation, they *did* risk evaluation. It was embedded in their actions, their movements, and in their everyday life when buying, cooking, and eating pork.

5. Discussion and conclusion

As the findings show, in the everyday practice of evaluating the risk associated with pork purchase, cooking and consumption, the risk of *T. solium* is perceived as just one aspect amongst many other risk factors our informants had to navigate. They were theoretically aware of risk associated with taeniosis, yet this knowledge did not inform their everyday pork meat related practices. Rather, this study shows how risk evaluation is two-dimensional and socially embedded. Their risk assessment did not address the worm, but a whole host of other things was manifested in their practices. This finding corroborates with the findings of Brown et al. (2022), where Cambodian women were more concerned about chemicals in food, than about the biological hazards that experts found to be more worrying. Thus, the practice of procuring food was informed by the experienced risk evaluation of the women, rather than the (to the women) theoretical risk that the experts were specifying. This is echoed in the study by Nesbitt et al. (2009), where they found that participants knew proper food safety practices, but they did not include them in their own practice. However, the literature on actual practices on risk evaluation is scarce and is an area of research that needs a lot more attention.

The practices of buying, cooking, and eating pork are heavily constrained by resource scarcity, and interpreted within a social and cultural environment where the social structures of village life also allows for a highly idiosyncratic risk evaluations based on influences from CoPs and situated life experiences. Thus, risk evaluation in practice is not only socially constructed, but also socially reproduced.

Furthermore, embedded risk evaluation in the kitchen does not happen only in rural African villages. In Western Europe too, risk analysis is embedded into practice. Considerations on what to do when finding mold on the bread in our kitchens, or when considering eating Sunday's dinner leftovers for lunch on Wednesday, are common embedded risk evaluation practices learned and distributed within our own CoPs.

Risk evaluation on practice level was analysed through a theoretical lens focusing on the significance of cultural norms and beliefs embedded into practice. Through these concepts, the social system of practices was reproduced and thus assigned meaning. The cooking practices, within which the risk evaluation must be understood, were socially learned and embedded in a community of practice that is under change.

This study demonstrated that risk evaluation in practice is situated within the buying situation, the cooking situation, and the situations of eating pork. Therefore, the personal experience and learned practices play a vital role when forming the experienced risk evaluation. This is echoed by Boholm (2003) where she describes risk knowledge as one of three modes: socially situated in time and space, science-driven, or as event-based media-derived narratives. The experienced risk dimension found in this study is somewhat similar to the experienced risk knowledge of Boholm (2003) by being situated in everyday life, being disseminated through small-talk and gossip, and being of high personal relevance. We did not find that the current media (radio, television, internet) narrative played any role in the forming of risk perceptions, nor were the formation of risk perceptions science-driven. Some informants had regular access to television and/or internet via smartphones, but the majority had not.

Risk evaluation studies focusing mainly on the theoretical dimension of risk evaluation are in danger of overlooking the important experienced dimension of risk evaluation and fail to take into account the considerable gap between knowing and doing i.e. how the theoretical knowledge of a risk translates into risk avoidance behaviour. By looking at the experienced dimension of risk evaluation and its situated embeddedness in everyday life concerns, we have shown the importance of context when it comes to ensure that risk knowledge becomes internalised and socially embedded in practices and hence shared in the communities of practice.

Zinn (2008) underscores that in risk evaluation "the underpinning logic is not one of cause and effect but one of analogy, a situation or event is like a previously-experienced situation and therefore the decisions, actions, and feelings from the previous situation are pertinent to the current situation". This understanding shares similarities with the two dimensions of risk evaluation that we found in our study. Moreover, it points to why risk evaluation carried out in the past can affect the risk evaluation of a present, particular situation, potentially making it difficult to change the outcome of a current risk evaluation primarily through providing new or more information. Sheeran et al. (2014) suggests that when interventions manage to change the perception of risk, the behaviour related to health often changes, too. In line with this, interventions must strive towards changing the risk perception of the people who live with *T. solium* in their communities. However, our study indicates that changes of *perception* might not be sufficient, because it addresses only the theoretical risk evaluation. Even if the real risk hypothetically were fully internalised and embedded by the informants, this might still not weigh up against the alternatives of economic loss by not selling the infected meat, being beaten by the husband if not cooking enough pork etc. Furthermore, there is also a relevant time-oriented element. A potential problem in years to come (for example if contamination of the village environment leads to neurocysticercosis) hardly competes with the problems of hunger/economic loss/personal threat today.

> When we give *more* information, we provide input primarily into the theoretical risk evaluation, where it is articulated, and thus can be measured through surveys and other quantitative methods. This, we have demonstrated, does not necessarily inform and instigate behavioural changes. We need to design intervention methods that make sense to people in the context of their everyday lives, are embedded in socially shared practices, and then contend with the fact that knowledge does not translate into action.

The contribution of this study also has methodological implications because it illustrates the benefits of using observation-based, ethnographic methods to study how risk evaluation is practiced and informs everyday practices with health implications. In our view, it is a necessary first step to design interventions that target practices in their social contexts, and acknowledge and address the two dimensions of risk evaluation.

The two-dimensional character of risk evaluation also has implications for health education intervention studies. As illustrated in this study, more theoretical risk awareness of taeniosis rarely motivates an evaluation of the associated risks, rather, the experienced risk awareness of the cooks outweighs the theoretical risk awareness and thus the embedded, situated, and particular circumstances guide the cook's actions and practices at a given time. The inclusion of the socio-economic context of risk related behaviour, and interventions co-created with the communities at risk are pivotal when developing future guidelines (Maaløe et al., 2021). Risk evaluation is cultural and contextual, and context must play a major role in the planning and execution of interventions aimed at controlling *T. solium* taeniosis. By aiming the healthy cooking literacy (or any behavioural change) directly at the CoPs affected, future intervention and research studies could hope to prolong the message of interest into the future generations. It takes time and requires a lot of personal investment, but it just might be worth the effort.

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CRediT authorship contribution statement

Karen Schou Møller: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Validation, Visualization, Writing – original draft, Writing – review & editing. **Séverine Thys:** Validation, Writing – original draft. **Sarah Gabriël:** Supervision, Validation, Writing – original draft, Funding acquisition. **Stig Milan Thamsborg:** Funding acquisition, Supervision, Validation, Writing – original draft.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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