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Men and women farmers' perceptions of adopting improved diets for pigs in Uganda: decision-making, income allocation, and intra-household strategies that mitigate relative disadvantage

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Abstract

Background: The roles and responsibilities of men and women in east African smallholder pig-raising households and the entitlements each can claim from pig-enterprise income are unknown. The article is a qualitative gender- and-household-head-disaggregated exploration of Ugandan smallholder pig farmers' perceptions. Asset ownership, control, and access; division of labour; and decision-making related to pig rearing and pig-enterprise income are presented in the context of the potential impact of adopting improved diets for pigs (a productivity improvement).

Results: Potential benefits of improved diet adoption included faster pig growth; increased farmer income and pig population; new on-farm employment and produce market opportunities; and improved pig market opportunities and family- and community-level well-being. Contradictory views about the potential impact of diet adoption on labour requirements and feed costs, and the inclusion of seasonal, home-grown ingredients were expressed. Concerns about people and pigs competing for food and personal safety were also voiced. Women allocated pig-enterprise income to provide for their children, household, and extended family, and spent only the remaining income on themselves. Men allocated income to meet personal needs, and to provide for their children, wife, second wife/family, extended family, and lovers. Men and women in female-headed households (WFHH) had overt decision-making ability over the pig enterprise and pig-enterprise income. Some women in male-headed households (WMHH) had overt decision-making ability over the pig enterprise and pig-enterprise income when their husband allowed it, or failed to provide, or was away. Pig ownership and labour investment by WMHH did not guarantee that women had decision-making ability or benefitted from pig-enterprise income. Some WMHH employed covert strategies which mitigated their relative disadvantage. Threat of domestic violence inhibited the decision-making ability of WMHH. Polygyny reduced intra-household communication transparency.

Conclusions: Diet adoption could benefit smallholder pig-raising households and farming communities, but lack of funds and human/pig food competition could limit adoption. Men, WFHH, and some WMHH had overt decision-making ability over the pig enterprise and pig-enterprise income. Men allocated income to benefit themselves, and their multiple families and lovers. Women allocated income to benefit their families and spent only surplus income on themselves. Women employed covert strategies to mitigate their relative disadvantage.

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Background

In sub-Saharan Africa, cultural norms strongly determine men's and women's roles related to livestock [1]. It has been well documented that livestock productivity improvements can improve the well-being of resource-poor smallholder farmers, but the benefits to household members and degree and type of investments (time/labour, financial) each contributes may differ between household members [1, 2]. Moreover, there is evidence that productivity improvements result in loss of entitlement by women and that ownership of livestock assets plays a significant role in determining entitlements to the benefits that are associated with those assets [2, 3]. "Gender considerations relating to access to and control over assets play a major role in determining how income does or does not translate into welfare" [4]. Women may not have an incentive to invest in productivity improvements if they are not compensated for any additional labour requirements above and beyond current demands [1, 5]. Moreover, a growing body of literature describes the inadequacy of models wherein households are viewed either as one entity with a single set of preferences (unitary models), or as multiple individuals operating in their own best interest (non-cooperative models) [4, 6, 7]. Rather there is a need for consideration of the complexity of relationships within households, i.e. individuals make decisions based on the interests of others and their own self-interest, and some interests are common while others conflict [6, 8].

Household members may have differing preferences and abilities to impact intra-household decision-making outcomes [4, 7, 8]. Agency, "the ability to define one's goals and act upon them" for example through decision-making, and gaining, retaining, and exercising command over goods and income [9] may differ between members of the same household. Some individuals may overtly exercise agency, while others may act covertly (e.g. through deception, manipulation, subversion, resistance, bargaining, and negotiation) in order to mitigate the relative disadvantage they experience [9].

Agricultural development projects need to be aware of the dynamic nature of gender norms related to roles, responsibilities, and assets and investigate the potential impacts that interventions may have on the ownership, control, and use of assets [2, 8]. There is a paucity of literature describing the roles and responsibilities of men and women in pig-raising households on smallholder farms in east Africa as well as the entitlements each can claim over the benefits from the pig enterprise. This

paper addresses that gap through a gender-disaggregated exploration of Ugandan smallholder pig farmers' perceptions of asset ownership, control, and access, division of labour, and decision-making ability related to pig rearing and income. These perceptions are presented in the context of the potential impact of adopting improved diets for pigs (a pig productivity improvement). Contrasts between Ugandan statutory and customary law are described.

Pig production and East Africa

Small-scale pig production in east Africa can improve the welfare of smallholder farm families and lift people out of poverty [10–12]. East African smallholder pig farmers typically raise 1–2 pigs to pay for medicine, school fees, food, home improvements, seeds, funeral costs, and to buy other animals and expand their farms [11, 13, 14]. Pig keeping is attractive for several reasons: pigs require minimal inputs and labour, produce offspring in large numbers, and have short intervals between generations [15]. The inputs required to purchase cattle and to manage cattle (e.g. amount of land required for grazing or growing feed, amount of purchased feed [e.g. Napier grass], amount of water consumed daily) are typically higher than those for pigs. When the inputs required to raise cattle are beyond the resources of farmers, especially disadvantaged members of society, raising pigs may be within their reach [16, 17].

In Uganda in 2013, 38% of the population earned \leq \$1.25 US dollars (USD) per day, and the gross national income per capita was low (\$600 USD) [18]. Six million people (43% of the working population) were involved in subsistence production—58% of whom were female [19].

Almost 30% of the 7 million households in Uganda were headed by females of whom 20.5% were divorced or separated, 35.8% were widows, and 5.3% had never married) [19]. The average monthly income of female and male household heads was 125,000 and 179,000 Ugandan shillings, respectively (\$37 and \$52 USD per month, or \$1.22 and \$1.71 per day, respectively, at time of publication) [19].

Traditionally women are not allowed to own cattle, but they are allowed to own pigs [20–23]. Given the high prevalence of poverty and the high number of people working in subsistence production, more than half of whom are women, it is not surprising that smallholder pig raising has become a popular enterprise in Uganda [18, 24]. In 2011, there were over 1.1 million smallholder farm families raising over 3.2 million pigs in Uganda [24].

This study, conducted in Masaka district in Central Region, Uganda, is part of a larger Smallholder Pig Value Chain Development (SPVCD) project lead by the International Livestock Research Institute (ILRI) looking at rural and urban pig value chains in Masaka, Mukono, and Kamuli districts of Uganda. Masaka district is an area characterized by mixed cropping of bananas, coffee, vegetables, and maize, and some dairy farming [25]. Masaka district was identified by ILRI as an area with high pig population and high poverty levels [11, 25]. The SPVCD project in Uganda, supported by the European Commission, the International Fund for International Development, and Irish Aid, focused on improving the livelihoods, incomes, and assets of smallholder pig farmers, particularly women, in sustainable ways, through increased productivity, risk reduction, and market access improvement in pig value chains.

One component of SPVCD was to develop balanced diets (recipes) for pigs using locally available ingredients (e.g. banana leaves, avocado, maize bran, sun-dried fish). Locally available feed ingredients for pigs were identified by smallholder pig farmers and government extension workers through focus group discussions (FGDs) [11]. Participants reported they did not know how to combine the ingredients into nutritionally balanced diets for their pigs and that commercially prepared pig diets were beyond their financial means [11]. Participants also reported competition between humans and pigs for the same food and that food/feed shortages happened seasonally [11]. Pigs were malnourished and growing slowly [22]. Others report higher pig growth rates on east African smallholder farms, resulting in greater potential profit and revenue for farmers [26]. Hence, improved, nutritionally balanced diets for pigs on Ugandan smallholder farms were needed to improve pig growth rates and increase pig-enterprise revenue.

Locally available ingredients were sampled and analysed to determine their nutritional content [27]. Low-cost balanced diets, designed to enable pigs to grow more quickly than pigs were currently growing on east African smallholder farms, were developed using suitable local ingredients [28, 29]. A feed trial conducted in Uganda determined the rate at which pigs grew when fed the improved diets. Farmers attended training workshops to learn about the nutrient content of locally available feed ingredients suitable for pigs, pig growth rates, and how to make the improved diets.

Study purpose

Prior to broader dissemination of the improved diets, exploration of the potential impact of diet adoption on smallholder pig-farming household members was needed. The average growth rate of pigs on

Ugandan smallholder farms will improve if pigs are fed the improved diets (Unpublished data Carter et al. 2016). Farmers earn more income per kilogram for heavier pigs than for light pigs (Unpublished data Levy et al. 2014). However, adoption of the improved diets may result in increased labour and resource requirements since home-grown ingredients must be collected, chopped, and mixed and some ingredients must be purchased. Labour and access to resources may not be evenly distributed among household members. The entitlements that household members may have over the benefits from increased pig productivity resulting from adoption of the improved diets may also vary and be influenced by societal norms, attitudes, and perceptions that shape ownership patterns and resource access. Others have documented east African gender norms associated with employment, and livestock and crop production, the ways in which gender norms vary between households, and signs that the gender norm *status quo* is not always maintained [1, 30–32]. The degree to which pig keeping benefits men, women, and families, as well as various family members' investments in pig keeping, is largely unknown.

The purpose of this study was to explore smallholder pig farmers' perceptions of the potential outcomes of adopting the improved diets on their farms; their potential to adopt the diets; constraints to adoption; ownership and access (land, pigs, cash); division of labour; allocation of pig-enterprise income; and the ways in which decisions about these topics are made at the household level. These topics were explored in the context of men and women's roles, responsibilities, and agency, and sex of household head.

Gender norms, statutory law, and customary law

Gender norms and disparities between statutory and customary law that dictate household members' ability to control, retain, and make decisions about investments and assets, and their within-household bargaining power, may result in differential benefit allocation between household members [1, 32, 33]. In this study, *customary law* refers to "customs that are accepted as legal requirements or obligatory rules of conduct; practices and beliefs that are so vital and intrinsic a part of a social and economic system that they are treated as if they were laws" [34]. *Statutory law* refers to "A law or group of laws passed by a legislature or other official governing bodies" [35]. Customary law is recognized by the Ugandan courts, and its impact is greatest on people in rural areas [36, 37]. Seventy-seven per cent of the Ugandan population lives in rural areas; thus, customary law impacts much of the population [19].

The 1995 Ugandan Constitution guarantees property rights "without bias to gender or marital status"

and “affirmative action in favour of marginalized groups based on gender or other reason created by history, tradition or custom, for the purpose of redressing existing imbalances (ibid.)” [36]. Although the Constitution “mandates that state law prevails where it is in contradiction with customary law”, the mandates are rarely heeded [36]. A disconnect between Ugandan statutory and customary law has been well documented [36–39]. Legal pluralism wherein statutory laws coexist and interact with “state, customary, religious, project and local laws” is enshrined in the Constitution which results in individual’s ownership of assets being based on legal and social norms [36, 37].

In Uganda, women are expected to be obedient and submissive to men and must seek permission from their husbands to work outside their domestic domain [20, 32]. This power differential is promulgated by the practice of bride-wealth payment (bride price). Women are responsible for tasks such as cooking, housekeeping, and childcare even when employed outside the home [20, 32]. Women are also responsible for pig and poultry-rearing [40]. Culturally, men are head of households and men are the decision-makers [32, 41]. They are responsible for providing an income and shelter [41]. Men are also responsible for rearing large livestock, especially cattle, and for marketing agricultural products [40]. However, as others describe:

Despite these inequities, women have been able to create room to manoeuvre through creative strategies that bargain with patriarchal discourses and practices, and re-re-interpret and subtly manipulate customary laws, norms and idioms back in their favour. For instance, they resist patriarchal norms by withdrawing their labour from their husband’s land and farming enterprises [42].

This study explores such creative strategies that Ugandan smallholder pig-keeping household members employ.

Methods

A qualitative study design was used. Questions were adapted from the gender transformative analysis of the value chain tool developed by others (see Additional File 1) [43]. Questions were pretested once and revised in consultation with Ugandan facilitators to improve clarity, and single barrelledness and to ensure cultural appropriateness [44].

Participants were recruited from 2 villages (1 near and 1 far from a market) in each of 3 sub-locations of Masaka district in Central Region, Uganda (6 villages total; 4 rural and 2 peri-urban). Villages were purposively selected based on known popularity of smallholder pig farming, and proximity to markets where pig-feeding ingredients were

sold [45]. District veterinary officers (VO) listed potential participants residing within the VO’s jurisdictional area ($n = 72$ participants). The inclusion criteria were: smallholder farmers raising 1 to 8 growing pigs who were men ($n = 24$), or women in female-headed households (WFHH) ($n = 24$), or women in male-headed households (WMHH) ($n = 24$) to enable exploration of “multiple, apprehendable, and sometimes conflicting social realities” [46]. Following a verbal script, VOs orally informed potential participants in person that they were invited to participate. A written letter of invitation written in both Luganda (the predominant local language) and English was left with each participant. The letter was addressed “Dear Sir/Madam” regardless of the gender of the participant. This is because women require permission from the head of their household to participate but social norms dictate that the request for permission be expressed subtly. All invitees agreed to participate. However, two men did not attend and five women did not attend but two of the women sent their primary-school-aged sons to represent them. No participants asked for data to be removed.

Focus group discussions (FGDs) were conducted in primary school classrooms in villages near participants’ homes. Transportation was provided when needed. Participants were welcomed and thanked for coming, given an opportunity to ask questions, and gave oral consent to participate. Trained facilitators orally administered a brief checklist one-on-one to each participant in each participant’s language of choice: English or Luganda. The checklist determined: gender, age in years (within 10-year ranges), level of education, marital status (married, widowed, single, other), if they are head of household and if not the gender of the head of household, number of sons and daughters, number of sons and daughters who participate in household farming, number of people living in the household and their relationship to the participant, number and type of pigs kept (piglet, weaner, finisher, gilt, sow, boar), type and number of other livestock kept, land area owned and cultivated, land ownership and rights, type of crops currently cultivated, farmer group membership status, and distance from where pigs are kept to market where pig feedstuffs are available. Participant answers were recorded (written) in English by facilitators. Participants were then assigned to 1 of the 3 gender-stratified groups (men/boy, WMHH, WFHH), told their group number orally, and given a slip of paper with their group number written on it.

Trained facilitators conducted a plenary lecture-style training about locally available feed ingredients for pigs, feed-trial growth performance results of pigs fed 1 of 3 diets (forage-based, silage-based, commercially prepared), relative cost of feeding each of the diets to pigs including if all ingredients are purchased or if some are

home-grown). Participants were then divided into their gender-stratified groups (to enable facilitators to establish a rapport with participants). In the gender-stratified groups, participants received hands-on training wherein participants chopped, measured, and mixed ingredients to make the forage- and silage-based diets under the guidance of a facilitator. Training was conducted in Luganda. Training material (printed handouts and projected slide presentation) content was mostly pictorial and translated to Luganda in deference to participants with no formal education, or partial/completed primary level education ($n = 1$ and $n = 24$ participants, respectively). Training was followed by a plenary lunch; then, participants returned to the same gender-stratified groups for FGD. All discussions were conducted in Luganda, audio-recorded, transcribed verbatim, and translated into English. Field notes were taken by a second facilitator who observed the FGD.

Data analysis

Data familiarization through immersion was done [47, 48]. All data were imported to Atlas.ti 7 (Scientific Software Development GmbH, PO Box 2466, Corvallis, OR, USA) for management. Data were coded, and latent thematic framework analysis was done [48]. Analysis focused on “maintaining the integrity of respondents’ narratives” [47]. Partial data analysis and verification were done by one researcher and further theme refinement followed until all themes were distinct, non-overlapping, and could not be further refined or collapsed. All stages of the thematic content analysis were reviewed by members of the research team to reduce possible bias and increase validity [49].

Participants

The first 9 semi-structured FGD included a total of 67 people: 24 men and 41 women (of whom 17 were WFHH, and 24 were WMHH), and 2 boys enrolled in primary school who were sent by their mothers (1 WFHH and 1 WMHH) to represent them and participated in the man/boy group. Of the men participants, 23 (96%) were married and 1 (4%) was single. All were head of the household except for 1 unmarried 17-year-old man whose father was head of the household. Of the WFHH participants, 10 (59%) were widowed, and 7 (41%) were single. All were head of the household except for 1 unmarried woman whose mother was head of the household. Of the WMHH participants, all 24 (100%) were married and their husbands were all head of the household. The final 3 semi-structured FGD were mixed (4 men plus 4 WMHH; 4 men plus 4 WFHH; 4 men plus 2 WMHH and 2 WFHH). Participants in the mixed-gender FGD had attended one of the first 9 FGD and were selected and

invited to attend the mixed-gender FGD by the VOs at the end of the first 9 FGD.

Results

Potential benefits of adopting the improved diets are presented in Table 1. Contradictory views about the potential impact of diet adoption on labour requirements and feed costs, as well as advantages and disadvantages of the inclusion of seasonal, home-grown ingredients in the diets, are presented in Table 1. Concerns about competition between people and pigs for food, because the improved diets contain avocado, jackfruit, and sun-dried fish (*Rastrineobola argentea* called *mukene* in Luganda) which people also eat, and food competition mitigating solutions, are presented in Table 2. When prompted about “the risks, dangers, [and] injuries one may get while preparing feeds for the pigs” participants described potential risks as well as strategies to mitigate the potential risks of harvesting, chopping, and going to buy ingredients. These are presented in Table 2.

Income allocation and beneficiaries

Intra-household allocation of pig-enterprise income and the degree to which household heads and other household members benefitted from it are presented in Table 3.

Overt decision-making

The ability of heads of households and other household members to influence intra-household decision-making outcomes differed. Instances when men and WFHH gained, retained, and exercised command over the pig enterprise and pig-enterprise income are presented in Table 4. Instances when men had overt control over their wives’ behaviour or used physical violence, or the threat of it, to retain overt decision-making ability are presented in Table 4. Instances when WMHH did and did not gain, retain, or command control over the pig enterprise or pig-enterprise income are presented in Table 4.

Our study indicates that WFHH and men gained, retained, and commanded control over the pig enterprise or pig-enterprise income. Some WMHH had overt decision-making ability when they were the owner of the pigs and their husbands did not choose to remove women’s command of the pig and pig-enterprise income, or in the absence of men, or when men failed to provide for them. However, some WMHH did not gain, retain, or command control over the pig enterprise or pig-enterprise income.

Covert strategies influencing the relative disadvantage of some household members

Instances in which WMHH employed covert strategies (negotiation, bargaining, evasion, exclusion of men, resistance, manipulation, and deception) that influenced

Table 1 Smallholder pig farmers' perception of the potential impacts of adoption of improved diets for pigs: men, women in male-headed households (WMHH) and women in female-headed households (WFHH) in Central Region, Uganda

Type of potential impact	Participant	Comment
Faster pig growth	Men (3)	Our pigs are going to grow very fast as compared to the way we have been feeding our pigs. We have liked the aspect of fast growth of pigs which are fed on these diets and one can easily get money out of them.
	WMHH (2)	[I] am so happy about this diet because our pigs have not been growing up very well because of the way we have been feeding them. However, if we follow these ideas of the new diets, I know our yields will improve. As a family, when we use these diets, our pigs will grow very fast, sell them and get money which will solve the financial problems in our homes.
	WWHH (3)	Because you see here madam, if we give the pigs the diets, they will grow at fast speed and we will sell them. We have been selling them after one year after reaching weight, but now we will be selling in 4 months. This will increase our income. We will sell and replace and even increase the numbers [of pigs we keep]... You may find that in one year you have sold about 3 pigs. Another difference will be in the time taken to selling the pig. We have been rearing them for one year and not even getting 100,000 shillings (approximately \$30 USD) for them, yet we have been using a lot of energy looking after them.
Increased farmer income	Men	There is going to be peace in our homes because a home without money is like hell but after the profits we shall be getting from sales, peace is going to prevail in our homes.
	WMHH	The benefits are going to increase, because we are going to rear pigs so that they grow well for the family to benefit. Our children will go to school, they will not be sent back home for school fees, because they cannot send your child from school when you have a pig and you don't sell it. The money will help us.
	WWHH	Your income would have increased... and your [household] expenditures may change. You may have to put money where you never used to spend it on because your income has increased for example you can put your children in boarding schools. Some activities will be reduced, so you do not have to work too much, like you can use hired labor, since you can afford it.
Increased pig population	Men	If we put in practice what we have learnt today, many people will join the pig industry in communities.
	WFHH	This type of diet is going to increase on the number of pigs we have been rearing. Because there is no more wastage like the way it has been. We have been using a lot of feeds which would end up being wasted but if we chop the tubers and vines then add in other ingredients, this will make us rear more pigs.
	WMHH	We have been selling them after one year after reaching [market] weight, but now we will be selling in 4 months. This will increase our income, we will sell and replace and even increase the numbers [of pigs we keep]... You may find that in one year you have sold about 3 pigs.
Improved market opportunities	Men	Organized market in our community... just in case there is increase in the number of pigs kept... and this means more money.
	WFHH	Boosted growth will increase on the number of pigs. We shall get an organized market, improved standards of living, be able to pay school fees and meet basic needs in our homes.
	WMHH	The market will increase, because buyers will come looking for the pigs because of their good quality: their weight and good meat. Even the feeding [of people] at home will improve.
Decreased labour requirement	Men	Mixing and feeding is easy and time saving and ... [it is] easy to prepare and keep silage. The pig pens are going to be easy to clean because we shall be putting little whereby pigs will eat and finish everything as compared to the vines and other grasses which we have been putting and at the end of the day some are wasted and make the pen very dirty.
	WFHH	There is this other diet that is easy to prepare that I have seen here. The diet which I have seen that is quick to prepare is the one we prepared first [forage-based diet] ... chopping sweet potato vines, add jack fruit, mixed with 2 cups maize bran and 1 cup <i>mukene</i> [sun-dried fish]. That is the feed you can quickly prepare and use.
	WMHH	We have even been using too much. I have been getting a bundle of sweet potato vines which you cannot lift and throw it in the pig pen. The pig eats what it can, the following day you remove and throw it away. Imagine the energy wasted.
Increased labour requirement	Men	If the new diets are adopted, time is going to change and will be attached to the new activities that are associated to new diets like chopping vines, tubers, banana leaves, papaya leaves, the avocados and jackfruits, mixing and combining, pounding <i>mukene</i> [sun-dried fish] ... All the activities require a lot of time and energy, thus time must be dedicated to the new activities. It's time consuming especially if you have many pigs and when it comes to chopping which may delay other activities. You are right if we are to use these traditional methods like the way it was today, you may take the whole day chopping.

Table 1 continued

Type of potential impact	Participant	Comment
	WMHH	...hard and tiresome to pound <i>mukene</i> [sun-dried fish] time consuming because of the many chopping... Extra labour is needed because one person can't handle all the pig related activities to prepare the new pig diets we have learnt today
	WVHH	We have not been chopping [the vines]. We just get them from the mound and throw it whole into the pig pen Ok since I was used to just throwing in the feeds, I see there the work is going to increase. I have to get someone to help me...yes, you see the work will increase as it is not the same as when we have been just throwing in the feed
New on-farm employment opportunities	Men	Not mentioned
	WMHH	People will get jobs because this kind of diet is associated with a lot of labour thus some farms will need to hire some employees to work on their farms
	WFHH	Also we will be creating jobs for our children. How do we get jobs for our children? There are children who roam about on the village begging. You tell them to fetch for you sweet potato vine and you give them some money, may be one thousand shillings [\$0.30 USD] for some quantity brought. That is to create jobs for others
Increased feed cost	Men	<i>Mukene</i> [sun-dried fish] is very expensive. I remember you talked about feeding pigs on <i>mukene</i> for the human being and that <i>mukene</i> is very expensive Fruits are very expensive in times of scarcity and even if we are to plant jackfruit and avocados trees, they will take five years to mature before we can make use out of them
	WMHH	There be will increase in expenditures to purchase ingredients that make complete diet. Jackfruit... avocado are very expensive and they are seasonal ... it might be hard to purchase in order to make a complete diet
	WFHH	The problem may be on the ingredients which we have to purchase, because currently we do not have the money. We may learn these things but fail to implement them due to the limited funds we have to buy the items. That is where I see a problem...because I may be here but I do not even have one hundred shillings (\$0.003 USD) on me, but I have my pig which may be 8 months old, it has not been served but I am just feeding it
	Men	...reduce on expenditures and cuts on the costs of buying maize bran
Decreased feed cost	WMHH	Reduce on expenditures on commercial feeds while not compromising on growth rates What I have observed, the way I have been feeding my pigs has been very wasteful and I have been spending too much money, but now with God's mercy...[!] want to implement what I have learnt today, so that I economize on feeding and reduce expenditures
	WFHH	I have benefited a lot...so if you add on this, the local diet that has been shown to us and the time the researchers say it will take for the pig to go to the market, I see we shall be saving. We have been feeding, but feeding with a lot of pain, using a lot of money; we have been buying maize bran, most of us who do not have land for growing crops, we have been using maize bran, almost 3 kg per day. We have been feeding a pig for a year to take it to the market. When you go into calculations, you find that the costs are very high. In fact, for me I decided not to carry out cost-benefit analysis of the pig enterprise because it may stop me from going on with it. I don't want to cost it. I have that fear
	Men	At the community level, we are going to make money since potato vines may be sold to pig producers hence development. Because sometimes when the tubers are in plenty, we tend to leave the small ones in the gardens but now, all that we have been throwing [out] is going to be sold to pig farmers We have learnt to economize on pig feeds because sometimes we grow potatoes and when it's overdue for human consumption we have been disposing it away. But we have learnt that we can prepare silage out of such tubers which is a very good meal for our pigs
Strengths of inclusion otherwise wasted products	WMHH	We have been using a lot of feeds which would end up being wasted but if we chop the tubers and vines then add in other ingredients, this will make us rear more pigs You are right madam because the feeds which can feed like 5 pigs, we have been using it to feed one pig but with this new technology, our projects are going to expand
	WFHH	But what I have really liked and what will help us, which I want my fellow participants to buy... you have a sweet potato garden which is ready for harvesting... you get the sweet potato vines, we have been leaving the sweet potato vines in the garden or even use it as mulch for the banana plantations, but now we are going to chop them...even we were leaving the sweet potato tubers in the garden, and the monkeys eat them. We are now going to conserve them as silage... For me I am willing to make the change. I am willing to make the best Secondly, we have been having some of the ingredients and we did not know their value. For example jack fruit. We have it, and we eat and even throw it away. We have now learnt, we shall be eating and saying "aaa, today I have eaten this one, this one is for the pig", because I will be expecting to get profit from it, so I preserve it for the pig
	Men	

Table 1 continued

Type of potential impact	Participant	Comment
Strengths of inclusion of home-grown ingredients	Men	I have liked the fact that these diets are made from things we have in our homes and gardens Sometimes tubers are plenty on market and traders tend to offer low prices however, we can use the tubers to prepare silage instead of selling the tubers at low prices
	WMHH	The local diet is easy to mix because we have all the required ingredients in our homes
	WFHH	[The ingredients] are even free; you do not have to buy them Another way we will benefit regarding the training we have had, the ingredients we are going to use will be got from our homes. We will not have to look for them from long distances, we will be getting them from our gardens. For example sweet potato vines and sweet potato, you may be having in your garden which is even very near to where you are going to make the diets from
Challenges of inclusion of home-grown/locally available ingredients	Men	Sir these fruits are seasonal. There are seasons when there in plenty and seasons when they are scarce. . . don't you think this might affect our incomes, because if it's a season when jackfruit is not there, we may move for long distances [trying to find them] and that is also money. But still I think we shall get these fruits
	WMHH	Adding on to the problems we may get...there are seasons when there are no jack fruits. . .even avocado. We will get problems then. This diet is not flexible because in dry seasons when some fruits are scarce, then one can't use the diet
	WFHH	Even when you have to buy [avocado], you buy when it is still on the trees. Or that which has fallen on the ground...or you go to the market...or if someone has excess. You cannot buy a basin of avocado or a bucket of avocado when the children have nothing to feed on. The main issue now is avocado is off season, even when you go to the market it is not available
New produce market opportunities	Men	For the fresh produces more suppliers will come on market due to the increase in demand Increase income due to selling potato vines to pig producers and increase income due to selling small potatoes formerly left in [the] garden to pig farmers
	WMHH	Ok we have been talking about how families would benefit and now we want to talk about how communities where we came from will benefit? Prices for agricultural products will go high
	WFHH	Not mentioned
Improved manure quantity and quality	Men	Increase in the number of pigs and as a result there will be increased manure to put on our plants thus produce good yields like <i>matooke</i> [bananas] and coffee
	WMHH	Manure got from pigs feeding on these diets will be of high class and when put on our plantations like bananas and coffee, we shall get good yield
	WFHH	The manure from the pigs will also be of good quality because the pigs are fed on a balanced diet. The <i>doodo</i> [green leafy vegetables] ...even the bananas grown with that manure will produce a lot, even the coffee. We shall reduce on expenditure because we will not be buying coffee husks, we will be using the manure from the pigs
Improved family well-being	Men	There will be peace in our homes because of profits from sales
	WMHH	We will be in a position to pay school fees in time and improved standards of living in our homes. Reduce on levels of dependence from our husbands thus peace will prevail because as women, the money we get from pigs clears school dues Boosted growth will increase on the number of pigs. We shall get an organized market, improved standards of living, able to pay school fees and meet basic needs in our homes As a family we are going to acquire new skills of feed mixing, chopping and preparing
	WFHH	I see we are going to benefit as a family because the pigs will be growing fast. [When they grow fast] we will be selling them Your income would have increased. . . , and your [household] expenditures may change. You may have to put money where you never used to spend it on because your income has increased for example you can put your children in boarding schools. Some activities will be reduced, so you do not have to work too much, like you can use hired labor, since you can afford it. Family income would have increased; the family will be happy. Where there is money, nothing can fail
Improved community well-being	Men	Women are going to stop gossiping because they will be busy attending to the pigs Poverty begins at the family level then to community, but if we [are] going to use locally available resources then the money which we have been spending on maize will be used to attend to develop our community

Table 1 continued

Type of potential impact	Participant	Comment
	WMHH	Development at community level whereby we shall be referred to as the best pig farmers in the region Our farms are going to act as demonstration farms in our communities because we have learnt the new idea of feeding pigs. And out of what we have studied, our pigs are going to look good hence attracting other farmers to come and inquire from us. And we are ready to teach fellow farmers the modern way of farming After we have learnt the modern way of keeping pigs, pigs are going to increase in our village and we shall have an organized market thus the traders will not find it hard if they wanted to purchase in our villages like the way it has been that they have been moving from place to place looking for pigs. They will just come and pack the vehicle somewhere and buy as many pigs as they want
	WFHH	The community will benefit: when you sell the pig, you buy from them, they get that money. Also instead of rumor mongering, we shall be chopping the sweet potato vines Also to the community: our neighbors, apart from admiring and copying what we will be doing, may benefit in this way. You may be having Muslim neighbors who have a SP garden. You will have to find a way of getting the vines from them, in a way by creating friendship; you can give them some money, by buying from them

intra-household decision-making outcomes about pig-enterprise income allocation, thereby mitigating women's relative disadvantage compared to men, are presented in Table 5. Instances in which men employed covert strategies (negotiation, evasion, manipulation, and deception) that influenced intra-household decision-making outcomes about pig-enterprise income allocation, thereby maintaining men's relative advantage over women, are presented in Table 5.

Compensation and motivation

Some women reported having raised men's pigs and then not receiving any financial compensation for their labour. Men reported that women were reluctant at times to clean pig pens because although women did a lot of the work associated with pig keeping, men were not transparent about pig-enterprise income. Other men argued that such behaviour only happened in the past and that nowadays men would not expect a woman to provide labour and not benefit from it. Women reported having to compensate men for raising pigs on men's land because women did not own land of their own. Women lost motivation to raise pigs when men borrowed pig-enterprise income from them and never paid it back. "Sometimes when women sell pigs, their husbands borrow money from them but they never pay back. And this makes women lose interest to continue rearing pigs" one man explained. Women also lost motivation when they contributed labour to the pig enterprise and their husbands gave pig-enterprise income to another woman. "Does the other woman also do something to be able to take money to this home, or he just siphons out the money to the concubine in [name of village], whereas I [name] I am working hard...cutting trees...we have reared the pigs together. Is that fair?" one WFHH said. A final example

from our study is of a man who exclaimed, "The women have got more points than men! You are winners! I like women. They are hard working. They stay at home, but if she does not like the project, it will not survive. She will make sure it fails. She will be saying 'that pig is for the man'".

Discussion

Men, WMHH, and WFHH listed faster pig growth, increased income from pig enterprise, and improved family well-being as potential benefits of adopting the improved diets. Men, WMHH, and WFHH also mentioned an increase in the number of pigs that would be raised which would result in an improved pig market, and better quality and/or increased volume of manure which would improve crop yields as potential benefits of diet adoption. Men, WMHH, and WFHH viewed the inclusion of local home-grown ingredients including waste products as a potential benefit. Men, WMHH, and WFHH described challenges associated with seasonal fluctuations in availability of some ingredients, and human and pig competition for food (discussed further below). However within the men, WMHH, and WFHH FGD groups, participants had contradictory opinions about whether feed costs would be higher or lower than their current spending, and whether more or less labour would be required compared to their current pig-feeding practices. Only WFHH said they may be unable to adopt the diets due to lack of funds with which to buy ingredients. Only WMHH and WFHH mentioned that extra labour (additional help) would be needed if the diets were adopted and that there would be a potential increase in on-farm employment opportunities. Only men mentioned a potential increase in produce market opportunities although WMHH did suggest that an increase in

Table 2 Potential risks and risk mitigation associated with adoption of improved diets for pigs by men, women in male-headed households (WMHH) and women in female-headed households (WFHH) smallholder pig farmers in Central Region, Uganda

Potential risk	Participant	Participants' perception
<i>Potential risk</i>		
Chopping	Men	One can cut off their fingers while chopping the feeds, if not done with care
	WMHH	Not mentioned
	WFHH	One can cut [his/her] finger while chopping the vines, tubers or papaya leaves
Collecting fruit and leaves	Men	Not mentioned
	WMHH	The child may fall from the tree as they try to get them [avocado, jackfruit, or papaya leaves] down. Even the tree can break, and the child falls down while looking for feed for the pig Avocados, jackfruit can hit [you] while picking from the trees Sap fall in the eyes while picking papaya leaves Banana leaves and stem can easily hit you while picking
Collecting vines and forages	WFHH	A person can fall off the tree as you climb to get the jack fruits. [Facilitator: Who falls?] The child
	Men	Sharp instrument like broke bottles, [inaudible] may hurt you while looking and collecting feeds
	WMHH	One can be bitten by a snake or caterpillar while collecting vines and tubers Can be hurt by sharp rocks while picking potato vines
Human and pig competition for food	WFHH	A person can develop back ache and chest pain because of carrying too heavy loads Too much work, you find that you almost do all the work, you find that you are fatigued, and you get old and sickly early in life You get stressed because you worry too much. You may find that psychologically you are stressed. In the name of God
	Men	There is going to be competition between humans and pigs especially when it comes to avocados, jackfruits and potato tubers
	WMHH	Our children are going to hate us because they are going to compete with pigs. We have been feeding pigs on the wastes... gone-bad avocados and jackfruits but after this training, pigs are supposed to be fed on good products. This is going to be hard to divide the fruits between our children and pigs We may experience hunger because some families survive on jackfruits as a meal. And some of these families keep pigs yet pigs are supposed to eat good products. [I] am seeing this as somehow hard to cope with
	WFHH	Not mentioned
<i>Mitigation of potential risks</i>		
Chopping	Men	Acquire chopping machines and protective gears [like] gloves, boots and overalls Work slowly with no rush to avoid injuries Hire someone else to help with risky task
	WMHH	Individually, we can get gloves Long-term solutions; buy machines
	WFHH	It is God who is protecting us. We do not have any [measures we currently use to avoid such dangers] There are small machines we can use for chopping the ingredients which we can use to make it easy. You may not even use the child but you sit and do it yourself. You can get a stool, instead of bending, to ease life [Facilitator: You said you can chop your fingers when chopping the feeds. How are you going to overcome that?] We can acquire what to use. However, we do not know how. [You said there is a machine that we can use to do the chopping. How can you acquire it?] It is expensive for us. It will be difficult to get. It will be difficult, but we maybe we can buy it as a group Using protective gear like the gloves protects one from getting diseases even if one has done farming for a long time. Even the cuts will not go as deep as when one is not protected [if] the chopping is done on a table; this even reduces the chances of cutting yourself even the more
Collecting fruit and leaves	Men	Not mentioned
	WMHH	Use sharp and long strong stick to pick avocado Climb with caution.... more careful and if kids are to climb trees, let the ones with experience do it
	WFHH	We can use a pruning knife to get the jackfruit from the tree. [Facilitator: But are there trees which are not very tall?] ... Aaaa, most of our trees are tall. But madam, we can plant improved trees, the crossed types. If what is coming in future and I am to keep livestock and I have land for cultivation, I will plant short tree varieties. There are those they say are grafted: avocado, mangoes, and even jack fruit grafted trees are there...yes they have started grafting it. It is there. These are short and will put on fruits at a short height. We can get the fruits without climbing the trees

Table 2 continued

Potential risk	Participant	Participants' perception
Collecting vines and forages	Men	Not mentioned
	WMHH	Buy gum boots ... [put gloves on our hands] to avoid crawling insects and caterpillars
	WFHH	Carrying things on the head is bad, but if you have a wheelbarrow, it becomes easy. Even for the children as well. It means we can use the wheelbarrow to overcome the problem of lifting heavy feed materials. [Facilitator: What about a bicycle, you can go with it further, everywhere?] But there might be thorns which can puncture the tyres. The bicycle can work, but the wheelbarrow can work anywhere. But families in the village with wheelbarrows are very few
Human and pig competition for food	Men	We hope to plant more trees and food stuff in order to address this challenge. Plant more trees so that we can avoid the worries which may rise between pigs and humans
	WMHH	For the children, we have to share equally and not to feed pigs only Train children to love pigs by telling them the benefits we will get out of keeping the pigs. This can be achieved by naming the pigs after [the children's] names and by showing [the children] the benefits like paying school fees in time and buying for them some clothes
	WFHH	The children at home will not spoil the feed stuffs we use at home now that they have known that they are useful to the animals. Remember it's the children who climb the trees to get the jack fruits. You will say, 'my children, you have got 3 bunches of jack fruit, let us reserve this one for the pigs, for tomorrow'. They will have started to realize the value of jack fruit to the pigs
Working collectively	Men	[Facilitator: Are there other things that could be done to decrease the risks?] Work in groups
	WMHH	For the chopping machine, we can form groups so that we can afford to buy. Or else can achieve it at individual level
	WFHH	Madam, when you want to reduce the work load, you have to put in money. If not then you reduce the stock, which we do not like. We are looking for means of increasing income; I do not have to hire labor. ... work as a group Ha, to get income, you cannot work in a group. I do not buy that one. Ha, we first do like this and feed the animals, then move to the next, when will they reach my home? For some they won't even turn up after they have done theirs. Aaaa let each one do theirs. For making silage for example, we can say let us move chopping from one to the other, but one may be having 5 pigs and me I have only one pig, will we chop the same amount with that one with 5? Yes for us we are happy with the way we are
Government assistance	Men	Not mentioned
	WMHH	Not mentioned
	WFHH	We have asked [the] government to assist for a very long time. You request them, they promise to assist but they do nothing. It is not good to rely on them. They promised to construct pig houses for us in order to improve on pig management; it is now over many years they have done nothing. They told us that there are certain organizations willing to assist us improve pig management. They are the ones, even you, facilitator. If you have a good pen, this type of feeding would be easy. But they have done nothing. Let them build expensive pig pens for us

agricultural product prices would occur which would benefit the community. Only WFHH suggested adoption of the diets would create job opportunities for resource-poor children. Only WFHH suggested that the potential increase in pig-enterprise income would enable them to hire help, thus decreasing their overall workload.

Participants expressed concerns about competition for food, between people and pigs. It is important to note that when the improved diets were developed the number of ingredients that are eaten by both people and pigs, and the volume of those ingredients were purposefully minimized to decrease the potential for food competition. However, there is a lack of inexpensive high-energy ingredients available for pigs in Uganda. To keep the cost of the improved diets low while ensuring diets met pigs' nutritional needs, it was necessary to include three ingredients that both people and pigs eat (avocado, jackfruit,

sun-dried fish). This study demonstrates that including ingredients that people and pigs both eat challenges farmers' ability to adopt the diets. Thus, research is needed about alternative energy sources for pigs to enable the development of diets containing even fewer or no ingredients for which people and pigs compete.

Participants also expressed concerns about potential personal safety risks related to diet adoption. It is important to note that the practices required in collecting ingredients and preparing the diets are activities already undertaken by smallholder farmers. The ingredients were identified through FGD with 1400 smallholder pig farmers and 280 key informants including local extension officers through an in-depth value chain assessment conducted in Kamuli, Masaka, and Mukono districts of Uganda [11]. The methods used to prepare the diets, such as harvesting sweet potato vine from fields, picking tree

Table 3 Pig-enterprise income allocation reported by men, women in male-headed households (WMHH) and women in female-headed households (WFHH) smallholder pig farmers in Central Region, Uganda

Who spends this way	Who said they spend this way	Participants' perception
<i>Spent to benefit household members</i>		
Men	Men	In a home, the needs/responsibilities of men differ from women. It's the role of a man to pay school fees for the children, look after the home
Men	Men	... most times it's the needs at home that force us to sell. We usually sell [pigs] due to emergency like school fees, sickness, and food
Men	Men	They use it to buy home requirements. They sell [pigs] when they have a problem. Let me tell you the truth, if for example a man is working in [name of village] and is not yet paid, but there are 3 pigs at home which are ready for sell, if there is a need at home, he would tell the wife to sell the pigs to meet the home needs like sugar, salt, food. So that by the time he gets paid, he has already covered the family needs. That is my experience
Men	Men	We get children's necessities, pay school fees, and to buy clothes for our wives. [Facilitator: And to buy suits for you?] We pay school fees for the children and buy our wives nice clothes. We only buy the clothes for the wives after we have accomplished the children's necessities. Women can be our witnesses. There is no way you can get 800,000 shillings and you do not give your wife [money] to do her hair, or get a new dress
Men	Men	...[buy] fertilizers, restocking
WMHH	WMHH	...as a mother you have to chip in or sometimes when children are going to school, men tend to provide the major requirements like school fees, books, pens and when it comes to things like sugar, eats, sanitary towels etcetera they don't want to know and definitely as a mother, you have to provide the remaining needs and that is how we spend our money
WMHH	WMHH	To pay school fees for our children, meet basic needs like sugar, soap and food etc. and restocking
WMHH	WMHH	It is for paying school fees for the children. The women are involved in paying school fees for their children these days. Few men are involved in the fights. It is school fees, buying clothes for them even home necessities like salt, soap and food. Buying clothes is only by chance for the women. We depend on donations from well-wishers
WMHH	WFHH	It is the woman who normally buys the pig in the home. She wants to get something to do at home. To help in looking after the children. It is the woman who feels the pain of poverty, not the man and decides to start rearing pigs
WFHH	WFHH	For school fees [Facilitator: Any other thing?] To buy home requirements like sugar, soap, salt, for health needs. Sometimes pay debts
Men and women	WFHH	...the man can take the money elsewhere. But for the woman the money is used in the family
Women	Men	[Women] will always want to restock
<i>Spent to benefit others who are not household members</i>		
Men	WFHH	The difference is that when men get money, they spend it all because they want to buy things for everybody
Men	Men	...as men, we have our own responsibilities ...thus if decisions are dependent on me like looking after my other family, my siblings and other needs if not to mention... For instance some men like me has more than one woman and I don't wish the first to know about my other family thus when it comes to selling things like pigs, ... [I] am happy not to tell my first wife the money gotten after sales because I have to meet [the] needs of other family as well because they are also my responsibility ...this portion is going to the other family and this portion will remain here
Men	Men	It's the role of a man ...if you lost a relative you are expected to contribute as a son-in-law, which is not the case with women
Men	WMHH	My husband after we have sold pigs, he disappears from home for a week with [his] other mistress until the money is all spent. Sometimes we sell and he brings half home and takes alcohol with the other the half. Some men have more than one wife with other children thus they can never be straight with their income
Men	WFHH	He even has a concubine, and he has to play that part too, he has to take [her] something. Will he be always taking empty coats there? He has had a bumper harvest from this home, so let him take there as well
WMHH	Men	If a woman happens to get money on her, she will hide it instead of bringing it out or sometimes send the money to their [ancestral] homes

Table 3 continued

Who spends this way	Who said they spend this way	Participants' perception
<i>Spent to benefit household and self</i>		
Men	Men	[The man in the scenario] asked [for] money to buy a suit. Us men we take long to buy clothes but women... they buy every now and then
Men	Men	In most cases men have not been fair with money gotten from selling pigs because if a woman requests him to help and sell the pigs, he will sell and bring half of the money and he can't explain where the rest of the money went. And I think that it comes due to dictatorship of some men. For instance, one of my colleagues in this group phrased it that women and land are assets and they are just bought. No it's not true. [Women] are also human beings like us and they deserve respect
Men	WMHH	Indirectly sometimes decisions are made by our husbands because when he gets to know that you sold pigs, he will not pay school fees, will not buy sugar, paraffin, food because he knows that you have money and he needs to spend it even when you are not forced directly
WMHH	WMHH	Does her hair nicely, and to cater for family requirements. For example, buy shoes for the child, which has been long standing because the father said he did not have the money. The onus is on the woman to see that the children's needs are met. Before getting a new dress for myself, I have to first clear the family needs. For example, a child may have spoilt something like the thermos flask and we had kept [that fact] from the husband. So you get a new one, you take the kettle for repair. These are the priorities which the man may not think about. The child does not have bed sheets; the man doesn't even know that need despite that you have pestering him... I buy the things needed at home. We do the hair only after we have met those needs
<i>Spent to benefit self</i>		
Men	Men	Yes, in instances where men take alcohol, money can be mishandled because he may end up boozing all the money instead of meeting the required needs at home
Men	Men	Sometimes after [selling pigs], men tend to divert the money in non-developmental issues
Men	WFHH	...he can just disappear without paying off the debts... you can sit and wait and the child may not even go to school, he has disappeared. He comes back drunk
Men	WMHH	...in houses where husbands don't meet their responsibilities like providing food home, school fees or those that take alcohol whereby after selling the pig, he will just go and drink all the money
Men	WMHH	For instance like the men who sell pigs and decide to spend the money recklessly when there is no food at home
Men	WMHH	Doc ... but it's the truth we do most of the activities while men are not at home and surprisingly even if the pigs belong to the man, you have to look after them and when it comes to selling time, he may not even give you a coin

fruits, chopping jackfruit using a machete, cutting avocado with a knife, and pounding dry ingredients with a mortar and pestle, are traditional local methods commonly employed by smallholder farmers. In the absence of mechanized chopping and mixing methods, traditional methods were considered the best alternative to maximize adoption feasibility. We recognize the risks associated with collecting and preparing diet ingredients and encourage farmers to implement safe practices to mitigate these risks.

Participants suggested risk-mitigating practices; however, it is important to note that some smallholder pig farmers may not be able to implement risk-mitigating practices which require cash purchases (e.g. buying gloves, gum boots, or chopping machines). This particularly applies to WFHH who said they could not afford to buy ingredients for the diets so may also be unable to

buy protective equipment. Rather they reported relying on God to protect them in the absence of risk-mitigating measures. Although a man participant said "Persistence and love for our pigs should be the number one aspect to drive us to look after our pigs without hesitations", research focused on removing factors constraining farmers' access to safety equipment and safe practices is needed.

Income allocation and beneficiaries

Men, WMHH, and WFHH said that adoption of the new diets would improve pig growth, which would result in increased income from pig sales. However, allocation of pig-enterprise income and the degree to which household members benefitted from it varied within and between genders. Men and women both said that men and women allocate pig-enterprise income to benefit people within

Table 4 Decision-making by men, women in male-headed households (WMHH) and women in female-headed households (WFHH) Ugandan smallholder pig farmers about buying and selling pigs and pig-sales income allocation

Who makes the decision	Who said they make the decision	Participants' perception
<i>Buying pigs</i>		
Men	Men	Men [normally buy the pigs] because they are the ones with money. It's men that plan for the welfare of their families, like paying school fees
Men	WMHH	... its women that normally buy the pigs however, after some time men also tend to come in but the fear is when men buy pigs and bring them home, after these pigs have grown up, they will just sell them even when they have not been looking after them. And if a woman wants to discuss something about the pigs, man will just tell the woman to "keep quiet" because after all the woman wasn't there when the man [inaudible] making money which he used to buy the pigs
Men and WMHH	WMHH	[Who normally buys the pig] depends because some of us it's men that buy pigs and others, it's out of our initiative. For those that said that it's men that buy pigs, they first sit as a family and decide
WMHH	WFHH	[In a home] women [usually buy the pig for rearing]. The woman decides to start the piggery enterprise. It is the woman who feels the pain of poverty, not the man and decides to start rearing pigs
WFHH	WFHH	I make the decisions. I am head of the home. So I have to decide for myself. Doctor it is like this, like what [name] has said; we are household heads, I decided to rear pigs with an objective, but they send our child away from school for school fees. You cannot sit when the child is not in school. You sell it and take the child to school
<i>Ownership</i>		
Men	WFHH	It is difficult to find a piggery enterprise that was started and belongs to both the man and woman. Even if it was started by both, it later belongs to the man
Men	WFHH	You may find out that even when men don't have ownership of our pigs and they have not contributed anything, they will sell the woman's pigs without asking or seeking permission
Men	WFHH	There are men in our communities who put up strict regulations in their homes. If a woman owns a project like that of piggery, she has to give him a piglet every time the sow furrows (farrows). Even when it furrows only two [piglets], one [piglet] is for the man. Even when you sell, you have to give him some money on top of the piglet because you are doing the project in his home
Men	WFHH	There is a man who sold a pig which had been given to a child by an organization called World Vision. He sold it to raise money for medical expenses for his sibling. The pig had been bred. The woman had no say on the selling. It is the men who make the decisions
Men	WMHH	... pig projects are our business and if you asked a man to help you, he may end up selling your pig or even ask for something when you sell
Men	WFHH	For the married couples, it is usually the men who decide. Especially if they are involved in the management. How can you not involve him when the project is in his home? [Facilitator: But it is your pig?] Whatever you do in his home belongs to him. He can even sell off your chicken. He sells it and even uses all the money
Men	WFHH	There may be instability in the home if the man looks for a buyer, when the pig belongs to the woman. Although the woman will usually not complain
Men and WMHH	Men	Sit and agree and if the reasons why you should sell the pigs are valid, then we can go ahead and sell the pigs. However, even if the pigs are not ours and purpose for selling is not valid, as men we don't let the women sell off the pigs even if they don't belong to us
Men and WMHH	WFHH	If it's a woman's project, she doesn't need to consult anyone but if it's a joint project, they sit and agree on when to sell and how the money will be spent
Men and WMHH	Men	It depends on the understanding between husband and wife. For instance, in my family each one owns a pig thus when it comes to selling, the owner decides. But when it comes to management, whoever is at home looks after the pigs. However, I buy maize bran and my wife collects other feeds
Men and WMHH	Men	[Facilitator: Finally, what we have been discussing that men are not transparent when spending money is it true or not true?] It is true, but not 100%. There are men who do it. We cannot say it even accounts for 60%. The men who have one wife, they sit and discuss, but those with more than one wife, they are not transparent. When we were looking for pigs to buy, we moved Sub County by Sub County but they were telling us to wait until the women came back before they could decide to sell to us. There was one family with 18 pigs which were ready for sale, and it was the number we wanted. The man had to consult with the wife. When I asked him who owned the pigs, he told me he bought them but it is the wife who looks after them
Men and WMHH	WMHH	It's the owner who sells the pig because we have contacts for pig traders and it's a [phone] call away and [a trader] will be at the farm

Table 4 continued

Who makes the decision	Who said they make the decision	Participants' perception
WMHH	WFHH	In the male headed households, it is the women who decide on how to spend the money, since the pigs belong to them
<i>Selling pigs</i>		
Men	Men	We don't allow [women] to sell pigs because they can be easily manipulated by the pig traders and we consider women to have no information about the prices. Thus we take the lead in selling. When it comes to how the money should be spent, it's men that take charge
Men	Men	When you give a woman liberty to sell the pigs, she will sell and spend money recklessly like buying children's clothes, buy things that are even of no use and not needed
Men	WFHH	[Facilitator: What about selling, who normally decides?] There the man gets involved. If the woman goes away for a burial at her [ancestral home], she can even get back to find the pig sold off by the man. I have seen that happen. My real brother has ever done that
Men	WFHH	It is like this most times; the women are not always free to decide because when there is a financial problem at home the man can order the woman to sell the pig to meet that financial obligation, because he has been squeezed onto the wall. Yet for her she had kept [the pig] for another objective. But the man uses it for his own needs. Even though the kids are ours, and we have to take them to school, still we have to discuss
Men and WMHH	WMHH	In most families in our villages, a man has his own pigs and a woman has hers thus when it comes to selling, the owner takes the lead on when to sell the pig
Men and WMHH	WMHH	Yes sometimes it's our husbands that look for the market but if he is not there, we look for the market
Men and WMHH	Men	Do I need to know whether my wife has money or not? When I know that what she is doing earns money? Unless I do not know what she is doing? Such situations do not exist, just like you have said it is a story. I believe there are people like that in Buganda, but I don't believe it is the voice of all of us. The majority people I have moved through are not like that. We wanted to buy pigs, we moved to homes a number of times, but men had to first consult with their wives on the price. We went to a man called [name], for them they discussed there and then how they were going to spend the money. We were to buy them a certain quantity of maize bran and do other things first before they could sell to us the pigs. That is the experience I have with pig farmers who we work with, except those who are not with us, it may be different
WFHH	WFHH	We are the ones who sell. Even for the male headed households. The man may come home to find the woman has already sold the pig if it belongs to her [Facilitator: When you asked him to look for a buyer?] You do not ask him. He can send a butcher to collect the pig from you after getting the money from him. The woman can chase the butcher away in case the pig belongs to her. In the end, it is the man who owes the butcher
WFHH	WFHH	It depends on the situations in the household. Like for us where we have young children, and grandchildren, we decide to sell the pig to meet a need
<i>Using pig-sales income</i>		
Men	WFHH	In most cases, it is the men who make the decisions. There is unfairness on the side of the women. There is no equity in sharing especially for the women and children
Men	WFHH	[What we are asking is, don't women have that liberty to make decisions?] Yea, they are shy...they talk but they are not listened to... Where the [name of the man in the scenario] are, they even make decisions on property that does not belong to them. After looking after the pig and it grows, when there are no school fees for the child, he decides that you sell it for the school fees. Even to the extent of saying that the enterprise is in my land
Men	WFHH	Doctor, I think since women are submissive, she could have yielded to avoid quarrels and fighting resulting into physical damage to her body. She could have decided to start afresh
Men	Men	[It's men [who decide what to do with the money from the pig] because men buy most of the things for the home like food, school fees etc.
Men	WMHH	There is a family where a woman went away from home for a time and when she got back, the husband had sold all her pigs and spent all the money got from sales
Men	Men	[Facilitator: in some groups women said a woman might initiate keeping a pig in their home, but when it comes to selling, the men take all the money, saying that it was reared on his land. Does that happen?] It used to be so in the old days. Some of the things may be true because they have experienced them, but it is not the majority. These days it is about 2%. Men no longer hoard money. Women these days know the laws. Since they are the ones at home most of the time, you cannot bring another pig for her to look after, when she does not benefit from it
WMHH	WMHH	My husband doesn't ask for money from me when I have sold pigs but he will ask how the money is going to spent. And he would be very happy because the burden to attend to such needs [will] have been lessened

Table 4 continued

Who makes the decision	Who said they make the decision	Participants' perception
WMHH	WMHH	However, sometimes you can decide on how the money is going to be used on your own. These days men no longer look after their wives. It's you to find what to do so that you can have what to put on and look good

their households. Men and women both said that men spend pig-enterprise income to benefit people outside their households (second wife/family, extended family, lovers). Men and women both said that men spend pig-enterprise income to benefit only themselves. While men and women frequently said that men's preference was to serve their own best interests, in particular to buy alcohol and sometimes clothes, some men said that awareness of "the role of a man" motivated men to provide for their children, their wife, needs of second wife and/or family, extended family, and lovers. Similar to our study, other authors report that at times men's income allocation served men's own needs and at other times served the needs of others [50]. The findings of our study support other authors' claim that gender stereotyping about men's spending preferences should be avoided [50].

One man said that women spend pig-enterprise income to benefit people outside their households (extended family), but no one else said this about women. No one said that women spend pig-enterprise income to benefit only themselves, but men and women both said that women spend pig-enterprise income to benefit both their household members and then themselves. Women were motivated by "the pain of poverty" and their preferences were to spend income to provide for their children, household, and extended family. Once other people had been provided for women would spend income on their own needs (clothes, hair). Perhaps women's stated preference to spend more income on their children than on themselves can be explained as discussed by other authors, "women in traditional societies may lack a notion of personal welfare because their identities are too closely tied to the interests of the household" [51]. Moreover, this "overlap between personal and household interests preserves intra-household inequality" [51]. Similarly, other authors describe the strong link between Ugandan women's identity and their domestic role [52].

A gender equality and development report claims that "increasing the share of household income controlled by women, either through their own earnings or cash transfers, changes spending in ways that benefit children" [53]. These findings, which are similar to our own, stand in contrast to other researchers who report that when playing experimental games, there was no evidence that women in eastern Uganda contributed more to the common pool than men [8].

Our findings are also similar to those whose discussions with smallholder farmers in Uganda indicated that men and women make agricultural production decisions based on the food security needs of their households, but at times income from agricultural sales may be spent on frivolous personal expenses rather than in ways that benefit the family as whole [31].

Our study demonstrates that Ugandan men and women allocated pig-enterprise income based on the interests of others (i.e. household members, second wife and/or family, extended family, lover), based on a mixture of their own and others' interests, or based on their own self-interest. Thus, Ugandan smallholder pig-farming households cannot be viewed as one entity with a single set of preferences nor as multiple individuals operating solely in their own best interest, just as other authors have cautioned [4, 6–8].

Overt decision-making

The ability of household members to influence intra-household decision-making outcomes also differed. Participants described many instances when men and WFHH gained, retained, and exercised command over the pig enterprise and pig-enterprise income. Men made overt decisions about buying and selling pigs, and about how pig-enterprise income was used. Some men bought pigs because they "are the ones with money" indicating men's access to financial resources was greater than that of women. Even if women provided all of the labour required to raise men's pigs, some men sold the pigs and refused to let women express their opinion about how the income was spent. If men and women owned pigs together, some men took control over decision-making. Men sold women's pigs unbeknownst to women and without women's permission and when women were away (for instance at a burial). Men sold pigs owned by children (gifted to them by World Vision) and the wife had no input into the decision to sell or how the income was spent. Our findings are similar to others who report that although women owned livestock they did not have full control over the use and sale of the livestock or livestock products (e.g. milk and eggs) nor were they able to make decisions about the use of income from sales of livestock or livestock products [1].

Table 5 Strategies smallholder pig-farming household members (men, women in male-headed households [WMHH] and women in female-headed households [WFHH]) in Central Region, Uganda, employ to influence pigs-sales income allocation

Strategy	Who uses this strategy	Who said they use this strategy	Participants' perception
Negotiation	Men	WFHH	You have no option but to get the necessities for the children, yet the man does not even recognize that contribution. He wants to be bought something saying that the pig was reared on his land. That we should at least buy a shirt for him
	Women	WMHH	It's the man because in the first place he was the one who bought the pig. However, if I tell him to sell the pigs because we have a need like school fees and he refuses, then I give up... maybe he has idea where the school fees will come from
	Men and women	WFHH	There are families who sit and agree on selling the pig in order to solve the family problems, but they are few. They discuss: we have this debt, let us clear it first
Bargaining	Women	WFHH	In the story, the man wanted to buy a suit while the woman was looking into the future. Where would they get the school fees from? Yet she also needed the clothes. However, she could see there was no other way of getting the school fees. There was unfairness, since the man insisted he had to get what he wanted without thinking about the woman's needs. The piglet which was to cater for the school fees was not his concern. The woman had to give in, she could not insist because then she would not be able to get the school fees
	Women	WFHH	You ignore him you ignore him and say, let me have my children go to school instead of getting nothing out of it. Because the man in the scenario was not realistic. He was selfish
Evasion	Men	WMHH	I want to respond to the gentleman who said that men are the head of a family and that women ask everything from them. It's true but the reason why we ask them everything is that men are not transparent with their money. For example when we harvest coffee, it's them that sell it and they can never tell how much they got out of the sales, when sell pigs, <i>matooke</i> [cooking bananas] or anything they can never tell the [amount of] money they get. Thus as women, we are left in suspense with no information and they are the reasons why we keep on asking needs from them. Yet if they sold and we sit on a round table and everything is explained, then suspicions wouldn't arise because both parties would be having info on where the money went
	WMHH	WFHH	Yes, the woman will not... try not to publicize the marketing, because she does not want the man to know how much [the pig] was sold for
	WMHH	WMHH	...the reason why we don't tell the money we get as women, sometimes our husbands are not home and leave little money that can't meet all the basic needs. Thus as a mother, you have to chip in. Or sometimes when children are going to school, men tend to provide the major requirements like school fees, books, pens and when it comes to things like sugar, eats, sanitary towels etcetera they don't want to know. And definitely as a mother, you have to provide the remaining needs. And that is how we spend our money
	Men and women	Men	The reason why we don't tell women how we spend our money; women are also not transparent either. If a woman happens to get money on her, she will hide it instead of bringing it out or sometimes send the money to their [ancestral] homes
Exclusion	WMHH	WFHH	If the woman gets money[and] buys an animal and involves the husband in the management, it ends up becoming his. That is the beginning of the problems. Thus, it is wise not to involve him in the running of the project. [Husbands] always use such statements: 'do not put up your project here if we are not going to share the proceeds'
Resistance	Men	WFHH	The man can ask the wife why she is asking him for money. The man can suggest that she sells one of the pigs, but in a way of suppressing the woman. Yet it was not the woman's wish
	WMHH	WFHH	[Facilitator: Just like in the story you have heard. Are there families like that in your communities?] It used to be like that, but it has changed these days We hear women and men quarrelling over the animals. Quarrelling that he sold the animal when she had taken it for breeding! We hear of a lot of disagreements

Table 5 continued

Strategy	Who uses this strategy	Who said they use this strategy	Participants' perception
Resistance and manipulation	WMHH	Men	For instance of recent my pigs gave birth to twelve piglets and even [my] wife's sow gave birth. But when time came for a doctor's visit, my wife doesn't want to meet doctors' bills and she wants me to pay the doctor always, yet she also owns pigs
Manipulation	Men	WMHH	Another thing is that men are not always at home thus we find ourselves doing everything, even when the pigs belong to the man. You can't let [the pigs] starve thus we ought to look after the pigs either ours or not ours
Manipulation and deception	WMHH	Men	I want to respond to the women where they said that we don't meet some needs and they meet them. They do it in a wrong way. If as the husband I have been able to pay school fees, pens and books and the money gets finished, then it not good for you as a mother to take your child aside and tell him or her that your father didn't buy A B C D but here they are. It's good to chip in but do it openly because this may create differences and misunderstanding between children and fathers. As a mother, bring all what you have so that it can be complemented by what the father has so as to meet all the needs of our child instead of doing it separately
Deception	Men	Men	For smooth run of a family, there must be necessary lies when it comes to issues of income and expenditures for both parties...
	Men	Men	Ooh Doc, such scenarios are very in our communities especially when it comes to money handling. Men have not been true, sincere and honest to their women. Sometime when women sell pigs, their husbands borrow money from them but they never pay back
	Men	WFHH	Sometimes men can be having their own animals for example pigs and even women do have theirs. He can say that we sell off yours and leave his to remain in order to solve his financial problem. He leaves his, saying that yours looks bad, or it is old
Deception and evasion	Men and women	WMHH	...men don't discuss issues concerning their homes but rather just act or just make decisions without asking. And that is why we give our children money/ needs in silence
	WMHH		A man says: It is good for the women to do their hair. We agree to that and we like it. It gives us pride. We even feel good for sponsoring it. But where does the money come from? It does not come from the streets, yet you do not sell pigs every day. Then how is it that when you sell a pig you remove the hair from the priority list? Where she gets the money from is what she is not telling us A WFHH replies: What she does is this; when she gets money, she does not spend all of it. She keeps some, and you can't know it. So she can use some of it when need arises Another WFHH adds:... a woman always keeps some money which they use when the man says he has no money

Some men said that men no longer behave that way, or hoard money, because women know the law (their marital benefits rights). However, some women who owned pigs had to give their husband a piglet or money as compensation for the pig being raised in the man's home. This was because even if the pig is a woman's project, the project belongs to the man because it is done in his home. Other researchers report similar statements by Kenyan smallholder farmer FGD participants, for instance, who stated "Everything with blood in the household belongs to the man" [54]. Although "women claimed to have some influence in the selling", it was men who owned the animals [54]. Therefore, men had the authority to sell animals and dominated decision-making about selling them despite women dominating decision-making about daily care of animals [54].

In our study, in some households, men and women each owned pigs and each made decisions about their own pig. Also some men had to consult with their wives about the price at which to sell pigs before a sale could be made.

At times men made decisions about how pig-enterprise income was allocated that women described as unfair and inequitable for women and children. Sometimes men indirectly controlled women's pig-enterprise income by refusing to pay for household needs requiring women to use their income instead.

Men also had overt control over their wives' behaviour. For instance, men did not allow women to sell their [women's] pigs. Men also ordered women to sell their [women's] pigs to solve a financial problem at home even

though women were raising pigs with another objective in mind. Other authors report that in Ugandan societies “women tend to abide by male authority to avoid community gossip and to keep their marriages ‘stable’” although some women are beginning to defy these cultural norms [32].

One WFHH suggested men used physical violence, or the threat of it, to retain overt decision-making ability. Moreover, she said women are submissive and because of potential physical harm a woman would yield and would not challenge a husband’s decision (about how to spend pig-enterprise income). Although only one woman mentioned domestic violence, her statement is notable, particularly since domestic violence is a sensitive topic about which participants may not have wished to speak. Other authors argue that “because women’s status is intertwined with their husband’s, there are strong social pressures for women not to reveal personal feelings about their marital relationships that might undermine their commitment to the established social order” [55]. This may explain why only one participant mentioned domestic violence.

In Uganda, many (56.1%) 15–49-year-old women reported having experienced physical violence since the age of 15 [56]. Most commonly the perpetrator was their current (60%) or former (18.9%) husband or partner [56]. Similarly, most (55.7%) 15–54-year-old men reported having experienced physical violence since age 15; however, far fewer men reported that their current (31.1%), or former (5.4%) wife or partner, was the perpetrator [56]. In Central Region, the location of this study, 28.9% of women and 20.6% of men reported that a husband was justified in beating or hitting his wife if she argued with him [56]. Also, if a wife goes out without telling her husband (for instance to sell a pig), 51.3% of women reported a husband was justified in beating or hitting his wife and 31.5% of men reported it was justified [56]. When the report was released, The Daily Monitor, a leading national Ugandan newspaper reported that Mr. Bedha Balikudembe, the communications coordinator of Isis Wicce, a women’s rights organisation, said that women accepted wife beating as a “sign of love from their husbands” [57].

These customary cultural attitudes are telling and indicate that customary law is in sharp contrast to statutory law, namely The Domestic Violence Act of 2010. As other authors describe, the act states that “A person in a domestic relationship shall not engage in domestic violence” [33]. Moreover, “The consent of the victim shall not be a defence to a charge of domestic violence under this Act” [33]. Other authors provide an in-depth discussion of the history and challenges associated with implementing this act, but for reasons of brevity we will not discuss it here [33]. Suffice to say that customary law associated with

domestic violence and the statutory law that criminalizes domestic violence are sharply juxtaposed within Central Region, Uganda. The threat of personal violence, and some men and women’s attitude that domestic violence is justified, undoubtedly play a role in women’s (in)ability to make decisions about pig buying and selling and the allocation of pig-enterprise income.

Men also had overt decision-making ability over pig buying and selling, and pig-enterprise income allocation even when they did not own the pig and even when the pig’s owner, a woman, had a different objective in mind when raising the pig. Other researchers report that livestock ownership at the household level is gendered, and women are more likely to own less valuable, smaller livestock (for example pigs) than men [58]. However, in their study of smallholder pig-keeping families in Gulu and Soroti districts in Uganda, other researchers reported pigs were owned by husbands in 66% of households and by wives/women in 23% of households [21]. Thus, fewer women than men owned pigs. Regardless, our study demonstrates that ownership of pigs and labour investments by Ugandan smallholder farm women did not guarantee decision-making ability, nor did it guarantee they would command or benefit from pig-enterprise income. Similarly, other researchers report that joint ownership did “not necessarily translate to joint decision making on assets” and that “within-couple inequality of rights can persist in joint ownership” [59]. Other studies also report that very few co-owners needed their co-owner’s involvement to sell or bequeath land which may explain the sale of pigs, a much less valuable commodity, without the co-owner’s consent [59]. The findings of our study support arguments put forward by other researchers, that future research and development projects in Uganda need to be aware of the complex nature of the gender norms related to ownership and asset control, and to investigate the potential impacts that interventions may have on the ownership, control, and use of assets [2].

Similar to men, WFHH made overt decisions about buying and selling pigs, and about how pig-enterprise income was used. Women in female-headed households gained, retained, and commanded control over pigs and pig-enterprise income allocation. Since they were head of the household, just like men, WFHH had overt decision-making ability.

In contrast, as mentioned earlier some WMHH did not gain, retain, or command control over the pig enterprise or pig-enterprise income rather their husbands exercised overt control. However, some WMHH gained, retained, and commanded control over pigs and pig-enterprise income allocation but reported “it depends”. According to WMHH, in some households, families discussed buying a pig and then men did the buying and in other households

women took the initiative and bought a pig. However, according to WFHH, it was usually the women in male-headed households, and not the men, who bought pigs because women wanted to alleviate household poverty so decided to rear pigs.

Although men said they did not allow women to sell pigs, WMHH said that if their husband was not available then women could “look for the market”. Moreover, WMHH said that if they owned the pig then they did not have to consult with men about how to spend the money, but if the pig was owned jointly then they must consult. These findings are similar to others who report the ability of smallholder farming widows in western Kenya to do “everything [related to the pig enterprise] all by herself” [30]. Moreover, other researchers report that in western Kenya, 46% females and 54% males negotiated the selling price with butchers indicating men and women are both involved in pig sales in east Africa [60].

In our study, some husbands did not ask their wives for money from the pig-enterprise. They only asked how the money was going to be spent, and were happy that their burden to provide was lessened, which creates an additional burden on women to provide. Thus, some wives had command over income allocation and their husbands did not try to remove or reduce their wives’ command. Others researchers report similar findings that “a woman’s relationship with her partner shapes her asset rights” [59].

Additionally, WMHH said that sometimes they could decide how to spend the income from pigs because their husbands were no longer looking after them. A study of gender and tourism work in Uganda reports similar findings that men’s support of women is waning and rather than help their wives, men have “resorted to unproductive alcohol drinking” [32]. In that study, one participant described herself as “both a man and a woman” in her household because she receives so little help from her husband [32].

Covert strategies influencing the relative disadvantage of some household members

As we have discussed, men exercised overt decision-making ability over pig buying and selling and over the allocation of pig-enterprise income and often spent the income outside their household or in their own best interest. Conversely, few WMHH exercised overt decision-making ability over pig buying and selling and over the allocation of pig-enterprise income and often spent the income on their children and only spent any surplus on themselves. Thus, women were relatively disadvantaged with regard to decision-making and benefitting from pig-enterprise income compared to men. Some WMHH employed covert strategies that mitigated their relative disadvantage as

did some men to maintain men’s relative advantage over women.

Negotiation and bargaining

Men and women both negotiated and bargained about how to spend pig-enterprise income. Some families negotiated by sitting and agreeing about how to spend pig-enterprise income. Women negotiated and bargained, mainly to provide for their children. Some women negotiated by suggesting household needs to their husbands such as school fees. Men bargained by stating that because the pig had been raised on their land, they required compensation such as a shirt, or a piglet, or money when pigs were sold. Women bargained by stating that they wanted something for themselves and something for their children. Then, when men bargained for something for themselves, women gave men what men wanted and relinquished what they wanted for themselves. Sometimes while bargaining, in order to get what they wanted for their children, women feigned ignorance that men were conniving with pig traders about the price at which the pig was sold and that men were giving some of the pig-enterprise income to another woman. Men negotiated and bargained on their own behalf, and on behalf of second wives/families/lovers, and maintained the relative advantage they experience.

Evasion, exclusion of men, and resistance

Men and women were both evasive about how much income they earned selling pigs (and other agricultural products). Through evasion, men and women were able to control how pig-enterprise income was spent. Men said that they were evasive because women were evasive, and because men needed to secretly provide for second wives/families. Women were evasive about how much income they earned from selling pigs so that they could secretly save money to be able to provide for their children in times of need when men said they had no money. As one WFHH stated, “...a woman always keeps some money which they use when the man says he has no money”. Women said they did this because men made decisions without discussing pig sales and pig-enterprise income allocation with women. Similarly, other authors report that men and women indicated that profitability of agricultural products is important for household well-being because it is used to pay for clothing, medical care, and school fees, but described instances in which men “fail to provide” so women must be “innovative” [31]. Women’s deception and secret savings mitigated the relative disadvantage of women and children and enabled women to provide for household members when men were unable or refused to provide.

Another strategy that women employed to maintain control over pigs and pig-enterprise income was to exclude men from pig management and care. By excluding men, men were less likely to take over the pig business and less likely to want a share in the proceeds. Therefore, women could retain command of pigs and pig-enterprise income allocation. Excluding men from the pig business mitigated the relative disadvantage women experienced.

Men and women both exercised resistance to influence pig-enterprise income allocation. Men and women quarrelled when men sold pigs without consulting with women. Through quarrelling, women made efforts in opposition of men's behaviour and refused to accept men's actions.

Women also exercised resistance by refusing to contribute their income to family needs (for instance medical bills) which required men to contribute instead. Women's evasion, exclusion of men, and resistance mitigated the relative disadvantage of women by enabling women to retain command of some pig-enterprise income.

Manipulation and deception

Women's refusal to contribute income to family needs may also be an example of manipulation. Men and women both employed manipulation as a strategy to influence pig-enterprise income allocation. Men exercised manipulation by being away from home a lot which forced women to provide the labour required to care for pigs since women "can't let them starve". Women exercised manipulation when they secretly gave their children gifts and money or provided for their children and told them that their fathers had not provided for them. However, men had paid for many of the children's needs and had run out of money, i.e. women were manipulating the truth. This created misunderstandings between children and their fathers.

Thus, secretly giving children gifts and money is an example of women exercising deception to mitigate the relative disadvantage their children experience. Women mislead their children about the amount their fathers had provided. Men were aware this was happening and implored women to give children money openly so that misunderstanding would not develop. However, men also said that lies about income and expenditures are necessary in order for a family to run smoothly; thus, deception was employed by both men and women.

Participants referred to open, honest communication as transparency. "Transparency between wife and husbands is not there" as one WFHH said. Men also recognized a lack of transparency saying "In most cases women don't believe in their husbands when it comes to money because transparency is not always there with things concerning money". Our study has demonstrated one reason

why this lack of transparency may exist, namely that men and women are attempting to mitigate or maintain the relative advantages and disadvantages each experiences. Other researchers report that when playing experimental games, even when they had control over resource allocation, men and women in eastern Uganda routinely held some resources back from the common pool [8].

Polygyny may also contribute to the lack of transparency between husbands and wives. Other studies report that aloofness between spouses and increasing age differences between a man and each of his subsequent wives result in less communication among polygynous couples [55]. In Central Region, Uganda, 75.9% of currently married women aged 15–49 reported they did not have a co-wife. However, 14.6% reported having one co-wife, 2.7% reported having two or more co-wives, and 6.8% did not know whether they had co-wives or not [56]. In the same report, 84.9% of currently married men aged 15–49 reported having one wife, and 15.1% of men reported having two or more wives ($n = 559$ women and 120 men interviewed) [56]. Moreover, 55.7% of rural Ugandan men and 12.5% of rural Ugandan women reported having had concurrent sexual relations for durations of 65.1 and 27.5 months, respectively, while with their previous 3 partners [61]. Given the prevalence of polygyny and concurrent relations, the lack of transparency between men and women about income allocation is not unexpected. Our study indicates that polygyny, and men's responsibility to more than one wife and/or family contributes to the lack of transparency between men and women. Moreover, Ugandan women whose husbands had another sexual partner were 2.4 times more likely to experience domestic violence than women whose husbands did not have another sexual partner [55]. This indicates that non-monogamous relationships are associated with an increase in domestic violence. Although only one participant mentioned threat of domestic violence as impacting women's decision-making ability, given the high number of non-monogamous men and the cultural acceptance of domestic violence, it is likely that threat of domestic violence impacted the decision-making ability of many women in our study.

Others studies report that "female researchers seem to obtain greater insights into the emotional nuances of co-wives' lives" [55]. A limitation of this study is that some FGD were co-facilitated by a man and a woman (one as facilitator and one as scribe), which may have decreased the degree to which women shared personal insights about domestic violence. However, women and men participants spoke frequently and freely about polygyny and concurrent relations related to allocation of pig-enterprise income. It is interesting to note that WFHH spoke more openly about instances wherein men took control

over pigs and pig-enterprise income than WMHH did (Tables 3, 4). The sole participant who mentioned threat of domestic violence was a WFHH. Thus, WFHH may have felt more able to openly discuss these topics than WMHH did given the public nature of the FGD. Lastly, WFHH suggested that WMHH took the initiative to buy and raise pigs and had more decision-making ability than WMHH suggested about themselves (Table 4).

Compensation and motivation

The inability of some women to gain, or retain or command pigs and pig-enterprise income meant they were not compensated for the labour they invested in pig rearing which affected their motivation to continue to raise pigs. As discussed previously, some men required compensation from women for raising pigs on their land (shirt, piglet, money). This results in a loss of income or potential profit for women which would be avoided if women owned land on which to raise pigs. In Uganda, few women who are not household heads own land by themselves (9%) or jointly [59]. This contributes to their inability to retain command over pigs and pig-enterprise income because they must raise pigs on land that is owned by someone else. More Ugandan women who are household heads own land by themselves (38%) or jointly (41%), but it is mainly Ugandan men who own land by themselves (43%) or jointly (53%) [59]. Similarly, other studies report that lack of control over land was an important concern for women in Bangladesh because women must give up 50% of their agricultural products to landowners [62].

Women's motivation to raise pigs was decreased when men borrowed pig-enterprise income from women and did not pay it back. Women also lost motivation when they worked hard and reared pigs with their husbands and then men gave the pig-enterprise income to their [men's] lover. Given the increased labour demands which some women would experience if they adopted the improved diets, despite the potential for faster pig growth and resulting increased income, if women anticipate they are unlikely to be compensated for the additional labour, and if they do not have decision-making ability over the use of pig-enterprise income, they may not be motivated to adopt the diets. Other studies also suggest that women and girls may be disinclined to adopt an agricultural productivity improvement if they are not compensated sufficiently to offset the additional labour they must invest [1].

Conclusions

Participants were confident in the benefits of diet adoption. Men and WMHH were confident they could overcome challenges associated with diet adoption. However,

lack of funds and human/pig food competition could limit the ability of WFHH to adopt diets. Men and WFHH had overt decision-making ability over pig rearing and pig-enterprise income. Some WMHH were able to retain the benefits of pigs they owned and raised but in some cases were restrained by men selling pigs and/or retaining some or all pig-enterprise income. Polygyny reduced the degree to which women benefitted from pig-enterprise income. Threat of domestic violence reduced the decision-making ability of WMHH. Women's relative disadvantage was mitigated by various intra-household strategies. Women and men distributed the benefits of pig-enterprise income according to their interests: these overlapped to varying degrees, depending mainly on whether men felt responsible for other women and children (other wives or lovers) and children and the desire to spend profits on personal needs. Women's ability to benefit from, and be compensated for, the additional efforts required for diet adoption is likely to have a major influence. Future agricultural productivity improvement projects need to be aware of the diverse nature of households with regard to intra-household decision-making, ownership, control, and use of assets and income, and the potential impact of domestic violence and polygyny/concurrent relations.

Additional file

Additional file 1. Data collection tool used in focus group discussions with smallholder pig farmers (men, women in male-headed households [WMHH], and women in female-headed households [WFHH]) in Central Region, Uganda.

Abbreviations

ILRI: International Livestock Research Institute; SPVCD: Smallholder Pig Value Chain Development project; FGD: focus group discussion; VO: veterinary officer; WFHH: women in female-headed households; WMHH: women in male-headed households.

Authors' contributions

CD, SH, DG and EO supervised the design, the entire data collection process, and provided guidance, corrections and supervision to the entire research. NC, CD, SH, DG and EO designed the data collection instruments. NC and EO pretested and refined the data collection instruments. NC gathered the data. Analysis and write-up were done by NC with guidance and corrections from CD, SH, DG and EO. All authors read and approved the final manuscript.

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We use the term gender throughout, rather than sex, because of the importance of culture in determining the roles and responsibilities of men and women, particularly given the emphasis on power relations between men and women in the Ugandan context.

Competing interests

The authors declare that they have no competing interests.

Availability of data and materials

Raw data will be placed in the open-access International Livestock Research Institute (ILRI) Data Portal. <https://data.ilri.org/portal/>. The ILRI Data Portal is an archive of ILRI datasets. The metadata of all ILRI datasets are publicly available. Access to the data may also be publicly available or only downloadable for registered users. Public available data do not contain sensitive information like names or telephone numbers. Full access to data is given on request. For more information, read our Open Data Policy available here <https://data.ilri.org/portal/policy>.

Ethical approval and consent to participate

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