

Decision-making Power of Women in Livestock and Dairy Production in Jordan



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Abstract

Women are heavily involved in livestock rearing and milk processing in many parts of the world. Yet the benefits of their labour are limited as men are responsible for marketing of the dairy produce and ownership of livestock. This study was designed to understand livelihood strategies employed by women and men to carry out the rearing of livestock and processing of milk products in South Jordan. The main purpose of this study is to explore livestock ownership, as well as labour expenditure and decision-making power in sales, purchases, and expenditure of income in livestock production and milk processing in the Khreisha villages of Jordan. The thirteen villages in the Khreisha area were selected purposefully for the study as they had previously identified the production of milk and *jameed* (a type of cheese that is very specific to Jordan) and related milk products as their primary livelihood strategy. The empirical data for this study was collected through a survey administered to 197 farmers (94 women and 103 men) in Khreisha villages. The survey data was complemented with 71 unstructured interviews with male and female participants in livestock and dairy production. Survey questions were designed to collect data about demographic characteristics of respondents, their primary and secondary economic activities, types of livestock owned, reasons for preference of ownership of specific livestock breeds, sex disaggregated patterns of ownership and control of livestock, gender composition and dynamics of cooperatives and group formation, problems encountered with livestock rearing and production of *jameed* and other milk products. Additionally, we tried to gain a sex-disaggregated sense of the most useful innovations for livestock production and milk processing. Our findings have revealed that although women are responsible for much of the labour involved in milk processing and livestock rearing, they have limited decision-making power and own few livestock heads in these two enterprises. We identify 11 cases where women increase their decision-making power in milk processing who were also commercial producers of *jameed*. We conduct semi-interviews with these 11 women and their families to understand the factors that enabled some women to transition from subsistence production to commercial production. Ownership of milk processing machines as well as purchase of milk by women themselves increases the ability of women to decide on the expenditure of related income. We argue that women livestock ownership and agricultural innovations, particularly those related to dairy processing, have the potential to increase decision-making power (joint or independent) for women to gain benefits from labour they invest in livestock rearing and milk processing.

Keywords: Livestock; Jordan; women empowerment; asset ownership; decision-making power

Gender and Livestock: An Overview

Livestock are an essential component of the livelihood strategies of the rural poor throughout developing countries, as they are the assets, capital and “insurance policies” of people without access to banks, and high vulnerabilities to crop failures, illnesses and other threats (Njuki and Sanginga, 2013). Livestock tend to be the primary livelihood activity especially for rural households and communities located in areas that are dry or have more extreme climates where crop cultivation is not as reliable (Archambault, 2016; Turner and Williams, 2002).

While there are numerous studies that suggest keeping livestock -regardless of type-increases livelihood security, Dumas et al. (2018) argue that current livestock development programs do not account for the increased time, resources and money invested into livestock, especially for women when touting the benefits of livestock production. Women are typically responsible for the daily care of livestock and thus are particularly at risk of becoming disproportionately burdened with the workload associated with virtually any new livestock innovations (Dumas, et. al., 2018; Fisher et al. 2000). The relationship between livestock and human labor is very complex and while livestock can provide benefits to male farmers by providing traction labor, their care also increases the amount of work demanded from women (Dumas et al., 2018). As such, technological innovations need to be made more accessible for women to make up for the demand in labor that livestock ownership places on them (Debela, 2016).

Regarding adoption of livestock technologies or improved livestock breeds, the literature reveals that unitary models, which attempt to understand adoption of extension technologies can be limited in that they assume every person in the household has the same needs and goals,

which are met equally by the family's economic activities. In terms of household economic activities in, including raising livestock, different subunits and individuals within the family may have different goals, differential access to resources and specific duties and roles in the family which also shape their needs and desires (Fisher et al., 2000, p. 204-209). Curry et al. (1996) developed a framework for gender analysis that takes other factors into account beyond a gendered division of labor, and related workloads. They considered questions such as who is responsible for what aspects of productions, who controls which resources, who holds knowledge about disease control, who is included in disease control and who benefits from disease control programs. While this framework requires more data on how individual incomes are gained and managed as well as the income earned by individual household members; it does offer greater insight into whether income management occurs collectively or is a source of conflict dominated by patriarchal power relations (Njuki, Mburu, Pimentel, 2013). Understanding these relationships within the household are important because it allows for tailoring project design to be more effective and deal with gendered inequalities.

One factor which determines individual in households' abilities to exercise control over benefits is asset ownership. Njuki and Mburu (2013) argue that assets are important to study because evidence suggests that women's asset levels, both in absolute and relative terms increase women's abilities to benefit from and participate in development programming, because assets empower women to be decision-makers and conditioning them to participate in programming (p. 22). The characteristics of livestock can make them an important asset for women because they are productive assets whose ownership tends to be more accessible to women than assets such as land (Njuki and Mburu, 2013). However, women experience different benefits from different types of livestock and certain types of livestock may be better suited for interventions regarding

women and livestock. For example, women have better access to small animals and the labor associated with their care may be more manageable for women who have numerous other duties. At the same time, many of the livestock types associated with women also yield much lower-value products, which also must be taken into account (Njuki and Sanginga, 2013). In Mozambique, Tanzania and Kenya, chickens were the most common type of livestock owned by women in all three countries. As such, they conclude that chickens are an important species for women. However, cattle were also found to be an important species for women because they are a much more profitable asset. Yet, for cattle to remain in women's ownership and control, there must be mechanisms in place to maintain it, as evidence suggests that men often attempt to control more profitable livestock assets (Njuki and Mburu, 2013). This study aims to understand the interplay between gender-specific roles, social and family relationships, livestock ownership, control, innovation access and preferences as well as the related income contributions and control in the context of rural Jordan.

Methodology

This study was designed to understand livelihood strategies employed by women and men to carry out the rearing of livestock and processing of milk products in South Jordan in Karak province. Thirteen villages in the Khreisha area were selected purposefully for the study as they had previously identified the production of milk and *jameed* (a type of cheese that is very specific to Jordan) and related milk products as their primary livelihood strategy. The empirical data for this study was collected through a survey administered to 197 randomly selected farmers (94 women and 103 men) in the Khreisha villages. Five women enumerators and three men enumerators were trained on conducting the survey. While women interviewed both women and men, men only interviewed men. We aimed to interview one member from each household,

mainly the husband or wife, and we aimed for an equal number of men and women participants in the survey. The survey data was complemented with 71 unstructured interviews with male and female participants in livestock and dairy production, selected through snow ball sampling technique. Survey questions were designed to collect data about demographic characteristics of respondents, their primary and secondary economic activities, types of livestock owned, reasons for preference of ownership of specific livestock breeds, sex disaggregated patterns of ownership and control of livestock, gender composition and dynamics of cooperatives and group formation, problems encountered with livestock rearing and production of *jameed* and other milk products, access to credit, sources of information about livestock rearing and milk processing and production. Additionally, we tried to gain a sex-disaggregated sense of the most useful innovations for livestock production and milk processing. We identify 11 cases where women increase their decision-making power in milk processing who were also commercial producers of *jameed*. We conduct semi-interviews with these 11 women and their families to understand the factors that enabled some women to transition from subsistence production to commercial production.

Findings and Discussion

We will start with the role of women and men in different aspects of livestock enterprises (milk, meat and dairy) and the respective contribution of these enterprises to household income. We then move to ownership of different livestock type and examine whether these patterns of ownership overlap with patterns of control, defined as ability to sell and purchase the respective type of livestock. We wanted to see if pattern of ownership and control overlapped. We then look at innovations which were adopted related to livestock and milk production and which ones were

beneficial and why. We end with problems identified in livestock and milk processing enterprises and explore who in the household control income from these enterprises.

Tasks

Women contributed significantly to livestock tasks, ranging from carrying out 48%-64% of the related management tasks (Table 1). Milking and cleaning the barn are almost exclusive tasks carried out by women. In few households, as men are more likely to be responsible for grazing livestock, women contributed to as much as 50% of the grazing tasks. Often livestock is grazed once a day and often livestock is moved when grazing resources become limited but are abundant in nearby areas, e.g. after harvesting of crops.

Table 1. Percent of livestock-related tasks carried out by women.

	Gender				Total	
	Men		Women			
	Average	N	Average	N	Average	N
Grazing	58%	4	51%	14	53%	18
Feeding	43%	10	50%	22	48%	32
Collecting Manure	60%	21	63%	33	62%	54
Watering Animals	59%	10	56%	21	57%	31
Cleaning barn	60%	24	63%	30	61%	54
Milking	58%	38	69%	39	64%	77

To gain an understanding of the financial contribution of each enterprise to the total household income, we examined the proportion of each enterprise contribution (Table 2). Livestock-related enterprises comprised a significant portion of total household incomes, and much more than crop production with highest, up to 40%, proportion attributed to milk and milk-related products (mostly *jameed* and ghee). The other percentages are mostly related to birds, poultry, which we have found to contribute much less to total household income (1-8%).

Table 2. Percent contribution to total household income by different enterprises.

	Gender				Total	
	Men		Women			
	Average	N	Average	N	Average	N
Crop Production	29%	30	15%	22	23%	52
Crop Labour	34%	5	36%	7	35%	12
Non-Farm Labour	56%	42	65%	32	60%	74
Milk Production	33%	29	46%	33	40%	62
Products of Milk	39%	67	43%	59	41%	126
Meat Production	43%	45	34%	30	39%	75
Other 1 Production	1%	1	11%	3	8%	4
Other 2 Production	6%	2			6%	2

As expected, men did most of the marketing (Table 3 and Table 4). However, roles related to selling of wool cannot be fully understood from our survey as the civil war in Syria has halted all export of wool and this has considerably decreased the sales of wool. Men assuming most of the marketing roles has significant implications on women's abilities to control the income even when their husbands handed over part of these earnings. Men exclusively did the marketing of milk in fewer number of households, but still did the majority of the milk marketing.

Table 3. Percent contribution of men to marketing of livestock-related products.

	Gender				Total	
	Men		Women			
	Average	N	Average	N	Average	N
Marketing Milk	89%	37	87%	12	88%	49
Marketing Meat	98%	44	87%	27	93%	71
Wool Marketing	94%	17	86%	18	90%	35

Table 4. Percent contribution of women to marketing of livestock-related products.

	Gender				Total	
	Men		Women			
	Average	N	Average	N	Average	N
Marketing Milk	56%	5	45%	2	53%	7
Marketing Meat	40%	1	64%	7	61%	8
Wool Marketing			52%	6	52%	6

Livestock ownership and control

Out of all livestock types on average, households in the thirteen villages owned the most of ewes, female sheep, followed by lambs and does (Table 5). This is not surprising as ewes are the most valuable assets in the household whereby milk and dairy products comprise the highest proportion of income in the region (as seen in Table 2 above). *Jameed* is often made from sheep milk which is desirable because it has higher fat content and fetches the highest price. The number of rams is low as well as bucks because rearing livestock, or male livestock, for meat production requires more resources, in particular high-quality feed, which is a problem to milking animals let alone for animals raised for meat (see problem section below). As such male ruminants are often kept on a smaller head count, and sometimes mainly for reproduction purposes. Lambs, or young sheep, are second highest in number. Lambing was needed in order for milk production to be sustained and lamb sales were also lucrative. Twinning, for example as we will see below, is seen as a desirable trait in livestock breeds and in technologies as it leads to more income from lamb or kid sales. Men reported a much lower average number of poultry perhaps because they were unaware of the number of poultry their wives were managing.

Table 5. Average number of livestock types owned by households.

	Gender				Total	
	Men		Women			
	Average	N	Average	N	Average	N
Milking Cow			2	1	2	1
Non-Milking Cow			20	1	20	1
Camel	200	1			200	1
Ewe	129	84	94	59	114	143
Ram	8	80	7	56	8	136
Lamb	43	60	28	48	36	108
Doe	18	53	18	46	18	99
Buck	2	39	2	31	2	70
Kid	8	33	12	26	10	59
Beehives	36	1			36	1
Poultry	17	41	41	42	29	83

Our findings reveal that women owned much less ewes, than men (Figure 1). Women explained that they own livestock by purchasing it from their own savings. Women explained that they are less likely to own sheep because their feed is the most expensive. As Figure 1 and 2 show, compared to ewes women owned significantly more does than ewes. Women themselves on the other hand in the survey reported less ownership of does than men reported women owned. It is possible that men themselves tend to associate goats to belong to women when women felt that all types of livestock are owned by men. Women heads of households were also more likely to own goats than sheep for an additional reason. In addition to sheep feed being more expensive that goat feed, feed subsidization applies only to medium-sized herds (50 heads). As such, women heads of households, who need subsidization the most, are marginalized from this scheme because on average they owned 7-10 heads. These women often opt for rearing goats instead of sheep, because goats “eat anything”, but sheep “only eat hay, which is expensive”. In

married households, “when the number of livestock owned is large, women are more likely to own few heads as a gift from their spouses”. Women also control the resulting offspring as well as the milk and dairy products of these heads. One woman who is a teacher explained that she saved up money from her salary and asked her husband to buy some livestock for her. The resulting income of these animals is controlled by her. Perhaps not surprisingly, women owned the most of the chicken in a given household (Figure 3). More women and men reported owning chicken than they have reported each other to own.

Figure 1. Ownership of ewes and rams by women and men.

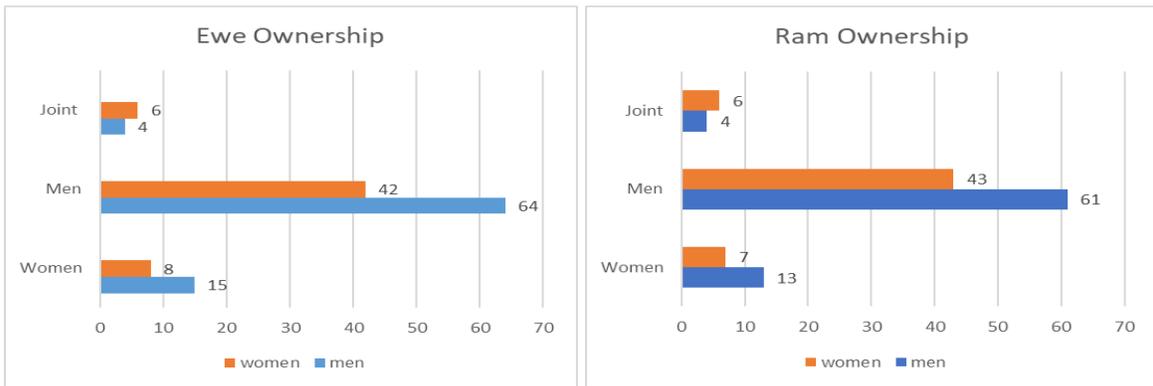


Figure 2. Ownership of does and bucks by women and men.

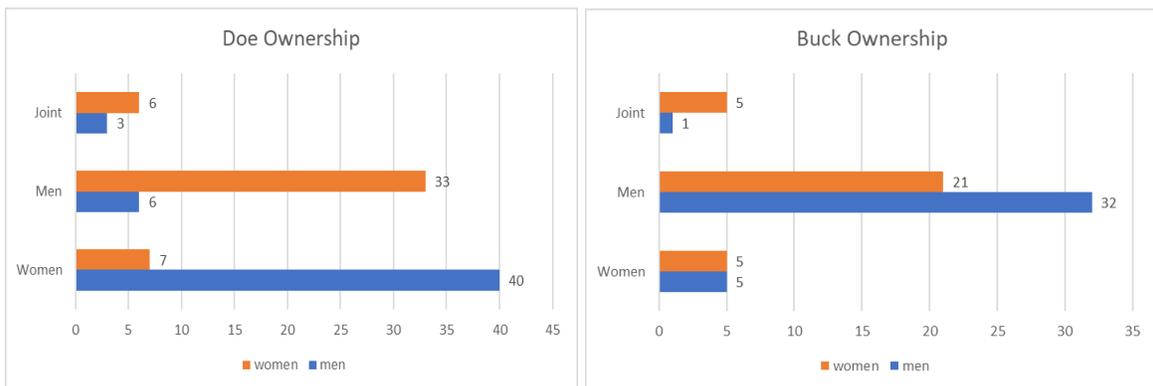
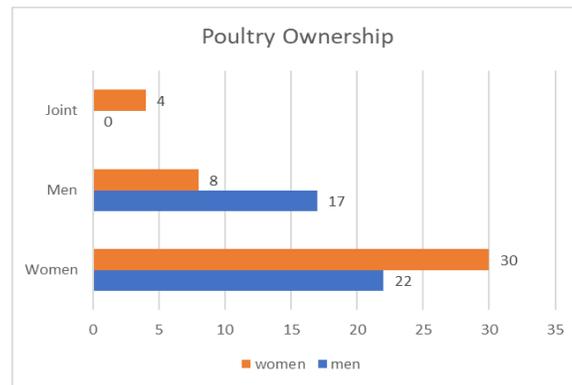


Figure 3. Poultry ownership by women and men.



The gender gap is equally large in decision-making around selling and buying ewes, rams, does and bucks, with buying having the most pronounced gender gap perhaps because men control financial matters in the household (Figures 4, 5, 6 and 7). Notably, women reported more joint decision making in cases of buying and purchasing than men did. Also, women reported more joint decision making with their spouses than taking decisions alone. However, it is not clear how these joint decisions are taken and the underlying reasons, e.g., whether women are more likely to consult with their husbands when purchasing or selling livestock because men tend to dominate livestock markets or because men tend to be in charge of purchasing feed and as such women required the approval of their husbands to purchase additional livestock, for example. A different scenario presents itself with regards to chicken (Table 8). The sale and purchase of chicken is dominated by women. Notably, more women and men reported selling and buying chicken themselves than they have reported each other to do so.

Figure 4. Selling and purchasing of ewes by women and men.

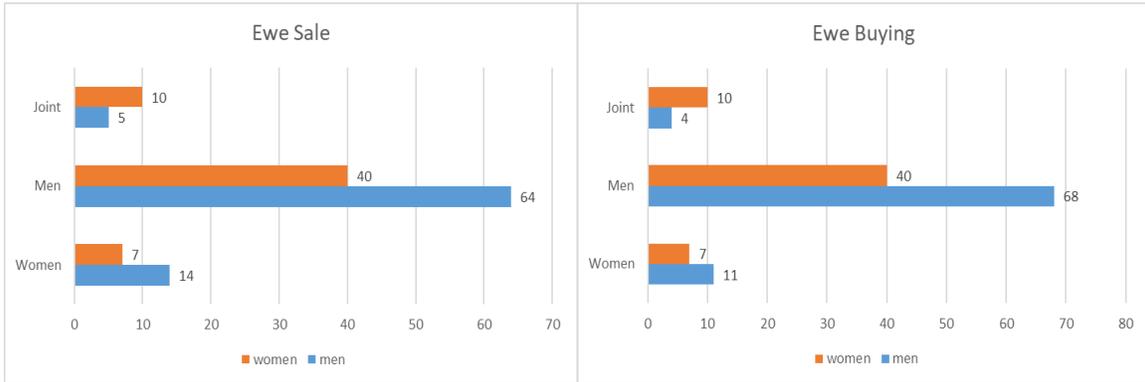


Figure 5. Selling and purchasing of rams by women and men.

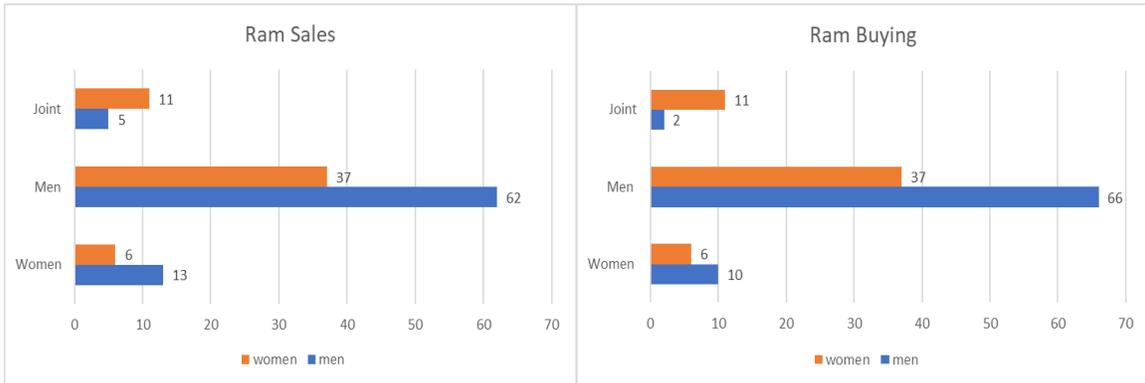


Figure 6. Selling and purchasing of does by women and men.

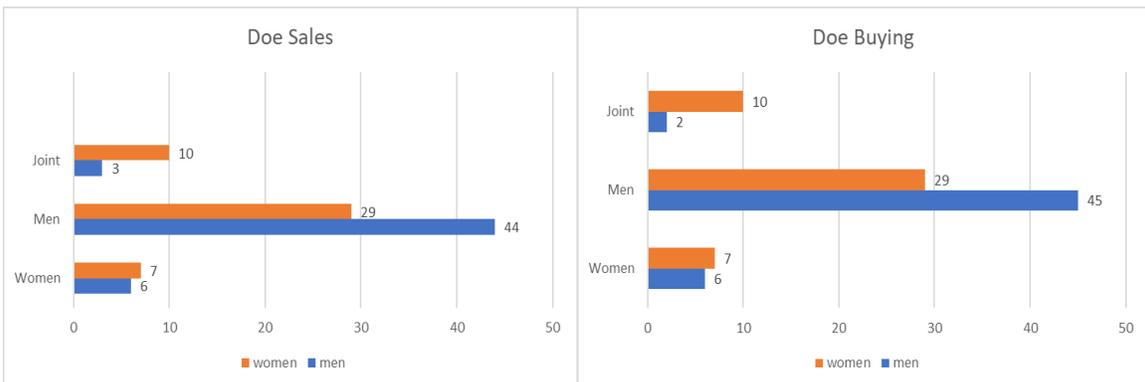


Figure 7. Selling and purchasing of bucks by women and men.

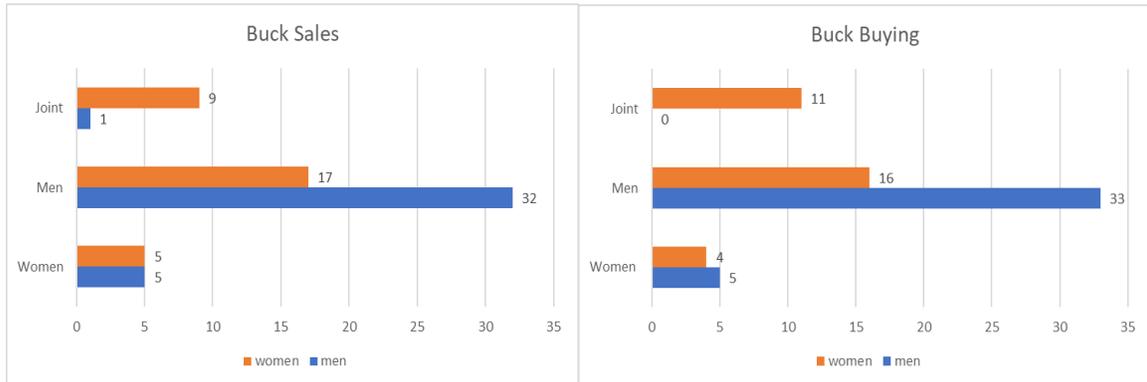
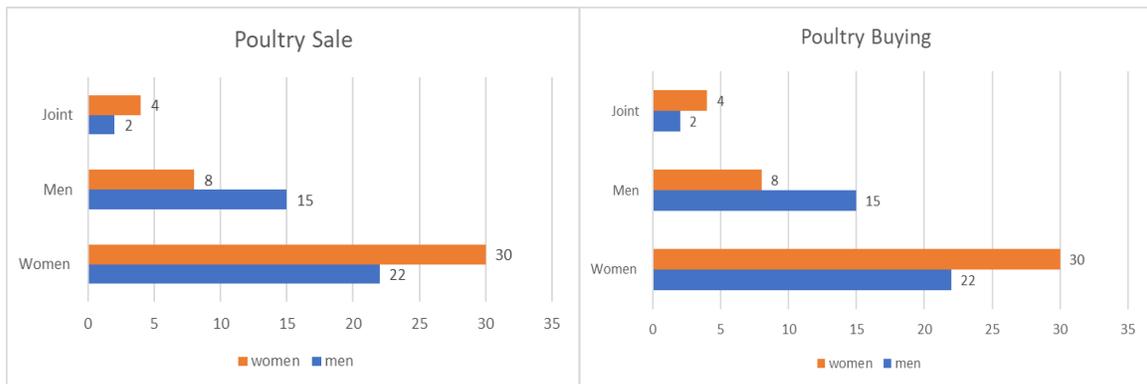


Figure 8. Selling and purchasing of poultry by women and men.



Livestock breed preferences

Men and women did not differ much in which breed they preferred. Also, there were few differences in preferences for the different livestock types (Table 6). For sheep, goats and poultry men and women consistency and predominately preferred the *baladi* or local breeds. *Baladi* sheep was preferred as it provided high milk fat content, better tolerance to extreme weather, high meat quality and more income. The white sheep breed was preferred for having more wool, higher quality of fat in milk and for being docile in temperament. For goats the *baladi* was similarly preferred for its better adaptation to the environment, higher price in the market, and high milk fat content. The *shami* goats were preferred for high levels of fecundity, in particular

as it was more likely to yield twins, good drought tolerance, good market prices and good quality milk. The black goat breed was preferred for yielding more milk with less fat content. The *baladi* poultry was preferred for higher egg count, more tolerance to diseases and lower production costs.

Table 6. Livestock breed preferences for men and women.

		Gender		Total
		Men	Women	
Buck Breed	baladi	35	26	61
	black	4	2	6
	shami	0	3	3
	Total	38	31	70
Doe Breed	baladi	40	32	72
	black	10	12	22
	shami	2	2	4
	Total	53	46	99
Ram Breed	baladi	64	45	109
	Na'emy	3	0	3
	white	12	9	21
	Total	79	54	133
Ewe Breed	baladi	65	45	110
	Na'emy	3	0	3
	white	15	13	28
	Total	83	58	141
Poultry Breed	baladi	31	36	67
	zera3ee	3	2	5
	Total	34	38	72

Innovation preferences

In this section innovations adoption, preferences and implications are explored. Innovations are both social and technological. We start with the social innovations then move to the technical innovations. Groups were identified as the most important social innovation that has entered the community by several leaders in the community.

Memberships in group

Survey findings reveal that a minority, few women and men, worked in or joined groups. Yet they mentioned the following benefits for working in groups reducing unemployment, saving time and saving effort. Disadvantages included having different opinions as a source of deterrent for working in groups, long distances traveled, lack of commitment, dependency on others, poor product quality, and lack of trust. Additionally, we have interviewed women and men who belonged to groups and they both told us that being in a group enabled them to access microcredit which was used to purchase livestock heads and solar panels. Some of these groups that focused on dairy processing were based on waged-salaries and most often men controlled the profits of the group with women receiving fixed wages. It is not clear whether this arrangement is just or fair. Some women we interviewed working in these groups mentioned valuing access to social protection and health care through being a working member.

Technical innovations: Livestock and milk

Both men and women gave vaginal sponges the highest mention of most important innovation adopted in the past decade (Table 7). Vaginal sponges were ranked highly because they increase birth rates, or the fertility of the sheep, including 'twining' or the possibility of having twins. They were also deemed important for synchronizing management of lambing which in turn saves time and effort. This was followed by early weaning and vaccination for both genders. Vaccines reduce diseases and improve the health of sheep and as such increase income. Early weaning was deemed important for providing early and more milk production and improving the health of the mother. The young born are sold at then anyways which in turn was a source of income and deemed as an advantage of early weaning. Fattening, forage mixture and cultivation of forage crops were mentioned by more men than women because these enterprises are considered in the

domain of men, and the three are interrelated. Fattening was deemed important because it increases income. Along the same lines, obtaining microcredit was mentioned by men as this was perceived in the domain of men. Some farmers stressed that these innovations are all good but for them to work well the rains need to be adequate: “rains determine whether or not this will be a good year”. The milk shaker was deemed important in processing of *jameed* which is considered a trademark of the karak area more generally. The milk shaker reduced effort, time and increased *jameed* production. *Jameed* from karak is under high demand and is known among Jordanians to be the ‘best *jameed*’.

Table 7. Most important livestock innovation adopted in the past decade.

	Gender		Total
	Men	Women	
Vaginal sponges	30	20	50
Vaccination	12	12	24
Early weaning	11	19	30
Milk shaker	6	4	10
Using medication	4	0	4
Fattening	3	1	4
Getting loans	3	0	3
Cultivation of forage and crops	2	0	2
Forage mixture	2	0	2
New varieties of forage	2	0	2
Artificial insemination	1	1	2
Extension	1	0	1
Flushing	1	0	1
Zero tillage	1	0	1
Vitamins	0	1	1
Total	79	58	137

When asked about the most important livestock-related innovation for women, men and women differed in their rankings (Table 8). Men gave the highest mentions to the milk shaker while women to early weaning.

Table 8. Most important livestock innovation adopted in the past decade for women.

	Gender		Total
	Men	Women	
Milk shaker	27	10	37
Vaginal sponges	12	9	21
Vaccination	8	8	16
Early weaning	7	19	26
Cultivation of forage and crops	1	0	1
Forage mixture	1	2	3
Vitamins	1	2	3
Artificial insemination	0	1	1
Fattening	0	1	1
Total	57	52	109

Women felt that higher production of milk is more important than saving time in processing this milk, which surprisingly they attached least significance to (Table 9). Men, on the other hand, were more likely to attach importance on time-reduction for women. This reflects women's prioritizing the well-being of their households over their own.

Table 9. Reasons for ranking top livestock innovation for women.

	Gender		Total
	Men	Women	
Save time	11	1	12
Increase fertility	7	7	14
Early milk production	5	3	8
High milk production	5	20	25
Increase income	5	1	6
Reduce disease	5	5	10
Synchronization of birth	4	4	8
Healthy sheep	3	5	8
Home consumption	3	0	3
Save effort	3	4	7
Cleaner	2	0	2
Fattening	2	0	2
Reduce mortality	2	1	3
Total	57	51	108

Similarly, when asked about most important innovation for men women tended to emphasize more the importance of early weaning (Table 10). Men felt that vaginal sponges are the most important for them, followed by vaccination and fattening. Women concurred with vaccination but not with fattening.

Table 10. Most important livestock innovation adopted in the past decade for men.

	Gender		Total
	Men	Women	
Vaginal sponges	28	20	48
Fattening	12	0	12
Vaccination	12	13	25
Early weaning	5	19	24
Cultivation of forage and crops	2	1	3
Forage mixture	2	0	2
Artificial insemination	1	0	1
Flushing	1	0	1
Livestock trading	1	0	1
Using medication	1	0	1
Zero tillage	1	0	1
Increase fertility	0	1	1
Total	66	54	120

When asked for the reasoning, both women and men valued increased livestock fertility and disease reduction (Table 11). Men favoured income increase. Women valued increased milk production more than men due to their choice of early weaning but this in turn also leads to an increase in income.

Table 11. Reasons for ranking top livestock innovation for women.

	Gender		Total
	Men	Women	
Increase fertility	18	17	35
Increase income	9	1	10
Reduce disease	8	12	20
Synchronization of birth	6	2	8
Feeding livestock	5	0	5
Reduce mortality	3	0	3
Increase meat production	3	0	3
High milk production	2	10	12
Healthy sheep	1	1	2
Livestock marketing	1	0	1
Save time	1	0	1
Early milk production	0	5	5
Fattening	0	1	1
Total	57	49	106

For the most part, when asked about the most important milk innovation the milk shaker ranked by far as the most important (Table 12).

Table 12. Most important milk innovation adopted in the past decade.

	Gender		Total
	Men	Women	
Loans	1	1	2
Milk shaker	77	70	147
Pellets for cheese making	1	0	1
Training course	0	2	2
Total	79	73	152

The reasons why it was preferred were almost equally distributed among men and women and related to saving time and effort. This was followed by cleaner products (ghee and *jameed*) (Table 13).

Table 13. Reasons for ranking top milk innovations.

	Gender		Total
	Men	Women	
Butter accumulation/ separation	0	1	1
Cleaner	7	8	15
High quality of products	6	1	7
Increase production	5	5	10
Increase share of capital / income	1	0	1
More experience	0	1	1
Purchase of milk	0	1	1
Save effort	24	23	47
Save time	33	33	66
Total	76	73	149

Most important innovation for women was not surprisingly also the shaker (Table 14). Women are largely responsible for milking and processing of related dairy products. Cheese making is not very common in the region, and as such renin pellets and cheese compressors figured out less prominently.

Table 14. Most important milk innovation adopted in the past decade for women.

	Gender		Total
	Men	Women	
Cheese compressor	0	1	1
Milk shaker	75	69	144
Pellets for cheese making	1	1	2
Total	76	71	147

The underlying reasons for ranking the milk shaker as the most important for women were related to saving time and effort as well as increasing the quality and production of dairy products (Table 15).

Table 15. Reasons for milk innovation top ranking for women.

	Gender		Total
	Men	Women	
Cleaner	1	0	1
High quality of products	10	4	14
Increase production	6	5	11
Increase share of capital / income	0	1	1
Save effort	10	7	17
Save time	37	30	67
Total	64	47	111

Most important milk innovation for men were also prominently the milk shaker but other technologies emerged and were more expansive than those for women (Table 16). This included fattening, cultivation of feed and vaginal sponges. These additional innovations are related to men's roles in livestock production.

Table 16. Most important milk innovation adopted in the past decade for men.

	Gender		Total
	Men	Women	
Cheese compressor	1	0	1
Cultivation of fodder	2	0	2
Cultivation of vegetables	0	1	1
Fattening	10	1	11
Grazing	1	0	1
Loans	0	1	1
Milk shaker	30	41	71
Pellets for cheese making	1	0	1
Use of bacteria in milk processing	1	0	1
Use of oven	1	0	1
Vaccination	0	1	1
Vaginal sponge	5	0	5
Yughort mixer	1	0	1
Increase (milk) production	1	0	1
Marketing	0	1	1
Total	54	46	100

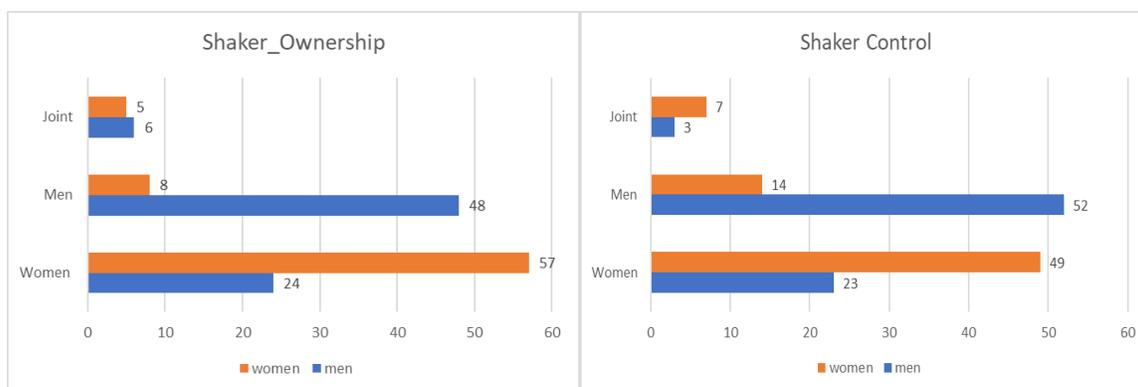
Similar reasons to women's innovation were provided for the importance of these innovations to men in terms of reducing time and effort (Table 17). Additional reasons were related to increasing income probably due to the breadwinner role assumed for men in the local society.

Table 17. Reasons for most important milk innovation adopted in the past decade for men.

	Gender		Total
	Men	Women	
Cleaner	3	12	15
Home consumption	2	1	3
Increase production	11	2	13
Increase share of capital / income	14	9	23
Reduce disease	0	1	1
Save effort	13	9	22
Save time	9	11	20
Source of livestock feed	2	0	2
Total	54	45	99

When it came to the ownership of the shaker, our findings reveal that women mostly owned it (Figure 9). However, considerable number of men also owned shakers in the households despite women exclusively assuming the role of processing milk. With regards to controlling the shaker, explained in the survey as having the final say in selling, both women and men reported more men controlling the shaker than owning it perhaps because decision-making power is vested in men in these households.

Figure 9. Ownership and control over shaker.



Problems faced in livestock production and milk processing

For problems identified in livestock production, the highest ranking was for limited fodder: both lack of pastures (aka free fodder) and the high fodder prices (Table 18). Following lack of rain fall, livestock disease and lack of medication were identified as a top problem by men. These problems are interconnected the pastures perform poorly with limited rainfall. Plastic residue was also mentioned as a problem mainly for goat rearing. Goat eat ‘anything’ and were more likely to be affected by plastic residue. Medication and diseases were mentioned more by men because dealing with the veterinary services and purchase of medicine is their domain. For women, following limited feed and low rainfall, women notably identified that heavy workloads related to livestock production as a top problem.

Table 18. Problems faced in livestock production.

	Gender		Total
	Men	Women	
Bad weather	0	2	2
Hard work	0	4	4
High death rate	4	3	7
High fodder price	18	13	31
Lack of fodder/ pasture	31	25	56
Lack of medication	7	0	7
Lack of water/ low rainfall	7	15	22
Livestock disease	8	2	10
No suitable place for breeding	1	3	4
No shepherds	1	0	1
Plastic residues	1	0	1
Lack of wool market	0	1	1
Total	78	68	146

In milk processing, the top problem predominately related to lack or slow milk fermentation (Table 19). This was attributed to cold temperature and the presence of antibiotics in the milk which prevents the fermenting bacteria from thriving. This process is important to happen for the

production of *jameed*, the trademark production of the karak area. Marketing, for men, and shaker failure, for women, followed as top problems faced in milk production which reflect the roles that men and women hold in milk processing in the study communities.

Table 19. Problems faced in dairy processing.

	Gender		Total
	Men	Women	
Bad weather	0	1	1
Difference in temperature	2	0	2
Cracking of jameed	0	1	1
Electricity cut	2	0	2
Hard work	1	6	7
High acidity of milk production	1	0	1
Lack of knowledge	2	0	2
Lack of laborers	0	1	1
Lack of milk	5	2	7
Lack of milk processing	19	28	47
Lack of time commitment	0	1	1
Low butter production	1	0	1
Mechanical failure	2	6	8
No marketing	3	1	4
No or long time for coagulation	12	12	24
Problems during heating	3	1	4
Slow milk processing	1	3	4
Soft butter	1	1	2
Unpleasant color of milk	1	0	1
Total	56	64	120

Control over income

An understanding of gendered livelihoods of livestock and milk production necessitates understanding who controls the income derived from these enterprises. Our survey findings reveal that compared to milk and meat production, a considerable number of women control income related to dairy products (Table 20). These findings suggest the innovations and interventions related to dairy processing are the most likely to empower women and increase their decision-making power in their households. Individual interviews with married women

reveal that support from husbands is especially important to enable women to establish and expand their milk processing enterprises. As this requires considerable mobility and interchanges with the opposite sex which local norms restrict for women. In addition to support from husbands, ownership of milk processing machines as well as purchase of milk by women themselves increases the ability of women to decide on the expenditure of related income based on processed dairy products. In many cases, we also found that women entrepreneurs are necessity entrepreneurs who are heads of households and have taken on dairy processing roles for the sustenance of their families. As mentioned earlier, it is important to reiterate that we found when women owned few heads of livestock as a gift from their spouses or purchase it from their own saving, whether milk or meat animals, they also controlled the income from this livestock which was noted to be on a much smaller scale than their husbands.

Table 20. Women’s and men’s control over income in different enterprises.

		Gender of respondent		Total
		Men	Women	
Control over Milk Production Income	Women	3	5	28
	Men	23	16	19
	Joint	2	12	14
	Total	28	33	61
Control over Products of Milk Income	Women	41	18	59
	Men	16	20	36
	Joint	7	20	27
	Total	64	58	122
Control over Jameed Profit	Women	19	30	64
	Men	34	16	33
	Joint	9	13	22
	Total	62	59	121
Control over Ghee Profit	Women	16	27	56
	Men	29	13	29
	Joint	6	11	17
	Total	51	51	102
Control over Meat Production income	Women	12	5	32
	Men	27	14	24
	Joint	2	9	11
	Total	41	27	68

Conclusions

Our findings concur with other studies on livestock ownership and gender which warn against assuming that household heads own all livestock in the household, obscuring the fact that women may own or make decisions regarding livestock, which in turn can influence the efficacy of development programming that targets livestock improvements (Njuki, Waithanji, Mburu, 2013). There is consensus amongst the literature reviewed that there is a gap between men's and women's ownership of livestock, either in number, in type or both. We found that women owned a smaller number of livestock heads than their husbands and were more likely to own goats due to its lower production and maintenance costs. Women in female-headed households were especially more likely to own goats. These specific ways in which gender can influence ownership are also reflected in Debela's (2016) study of Northern Ethiopia found that female-headed households owned significantly less livestock than male-headed households, which is likely related to female-headed households having less access to land, a lack of male labor and fewer children in the household. Female headed households have a lower capacity to own large numbers of livestock, which require more land and more labor.

Our findings concur with others that even when women owned livestock, they owned far less heads than men, and that chicken are the most accessible form of livestock for women yet are the least profitable (Njuki and Sanginga, 2013; Njuki and Mburu, 2013; Radel and Coppock, 2013). We also found that empowerment is an important aspect in ensuring women's ownership of livestock and the benefits associated with it (Galie et al., 2018; Daley et al. 2017; Njuki and Sanginga, 2013; Price et al., 2018). Women who had more support from their husbands, more mobility and decision-making power, were more likely to own livestock and have profitable and

more commercial dairy processing enterprises. We also found that women typically acquired livestock through purchasing animals with their own income, sometimes through a loan, or through gifts from their husbands, despite other studies suggesting that women typically acquire livestock through inheritance. Gender gaps in ownership and control of livestock are particularly salient in shaping and constraining the life outcomes of women and men differentially, worldwide (Radel and Coppock, 2013). Despite an increased sense of security, the time investment involved in keeping livestock was articulated by women as one of the most impactful cost of keeping livestock (Dumas et al., 2018). Our findings suggest that development programs are well advised to focus on making labour-reducing technologies available to women in livestock production and facilitating women's ownership of livestock and dairy processing technologies.

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