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Gender roles and constraints in the aquaculture value chain in Western Kenya

Cecilia Muthoni Githukia[1,5]*, Silke-Silvia Drexler[2], Kevin Odhiambo Obiero[3], Bryan Otieno Nyawanda[4], Judith Achieng' Odhiambo[5], Joshua Wafula Chesoli[6] and Julius Otieno Manyala[7]

[1]Kenya Marine and Fisheries Research Institute, Kegati Aquaculture Centre, P.O. Box 3259, Kisii, Kenya.
[2]Department of Water, Atmosphere and Environment, University of Natural Resources and Life Sciences, Gregor-Mendel-Straße 33, A-1180 Vienna, Austria.
[3]Kenya Marine and Fisheries Research Institute, Sangoro Aquaculture Station, P.O Box 136, Pap-Onditi, Kenya.
[4]Kenya Medical Research Institute. P.O. Box 1578, Kisumu, Kenya.
[5]Faculty of Agriculture and Natural Resources Management, Kisii University P.O Box 408, Kisii, Kenya.
[6]Faculty of Business and Economics, Kisii University P.O Box 408, Kisii, Kenya.
[7]School of Spatial Planning and Natural Resource Management, Jaramogi Oginga Odinga University of Science and Technology, P.O. Box 210, Bondo, Kenya.

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Aquaculture plays a critical role in food and nutrition security, economic empowerment and creation of employment opportunities for millions of people. However, the benefits from aquaculture are not evenly distributed between men and women due to gender-based constraints which limit maximum returns. The present study investigated gender roles and constraints in the aquaculture value chain in Western Kenya. A household survey was conducted among 384 randomly selected farmers using structured questionnaires in three counties in Western Kenya. Results of the study reveal gender participation at different nodes of the value chain with women representation being low (32%) compared to men (68%). Gender based constraints affecting participation and benefits include access to productive resources and start-up capital and discriminatory gender norms which limit women participation and financial returns. Therefore, abolishing these constraints is imperative in increasing production for development and social wellbeing of not only women but the entire household, community and the nation at large.

Key words: Aquaculture value chain, gender roles, constraints, social norms, poverty, wellbeing.

INTRODUCTION

The State of World Fisheries and Aquaculture (FAO, 2018) draws special attention to the critical importance of fisheries and aquaculture for food and nutrition security, as well as employment for millions of people, many of whom struggle to maintain reasonable livelihoods. As the fastest-growing food-producing sector in the world, global aquaculture production grew at an average annual rate of 6.6% since 1995 (FAO, 2017). This positive shift is expected to continue; to meet the food and nutrition security, employment, and provide economic empowerment to the ever-growing population (FAO, 2018). For the past decade, Kenya's policy and legal

*Corresponding author. E-mail: cmuthoni230@gmail.com.

frameworks have recognized aquaculture as one of the flagship projects to spur inclusive economic development. Demand for fish is increasing rapidly, driven by population and income growth, increased awareness of health benefits of fish consumption and changes in lifestyle and consumer preferences (Githukia et al., 2014; Obiero et al., 2019). However, fish supply lags, owing to declining natural fish stocks which necessitated increased fish imports in Kenya, especially Nile tilapia. Aquaculture is the most suitable alternative to capture fisheries to produce fish given the changes in climate, while also delivering co-benefits for environmental sustainability, nutrition and livelihoods (Munguti et al., 2017). Therefore, sustainable intensification of aquaculture will serve to fill the ever-widening fish demand-supply gap (Munguti et al., 2017).

However, the benefits from aquaculture are not evenly distributed between men and women due to differences in endowments and constraints associated with access to factors of production (Harrison, 1995; Ndanga et al., 2013; Kruijssen et al., 2018). The aquaculture sector is often considered a male domain because of the high levels of investment and the adoption of new technology associated with its development (Kumar et al., 2018). While fisheries and aquaculture industry empower women and contribute to gender equity; however, their role has largely been unrecognized (HLPE, 2014). Women occupy a central place in the aquaculture sector by virtue of them being at home most of the time, which unfortunately makes fish farming to be assumed as an extension of domestic duties, and therefore unrecognized and unrewarded (Ndanga et al., 2013). It is widely acknowledged that women are engaged in aquaculture in myriad ways, contributing significantly to the overall well-being of households; but the women themselves often get very little benefits in return due to deep-rooted gender disparities in social, cultural and economic spheres (Medard et al., 2001; Harrison et al., 2016).

Besides, women face stiffer constraints compared to men when it comes to access to factors of production which are often owned by men as head of the household and therefore the sole decision-makers (KMAP, 2016; Rutaisire et al., 2010). This limitation further constrains women's ability to access credit facilities since these assets form collateral. As a result, women's contribution is not commensurate to the benefits they enjoy from fish farming. Persistent differences and disparities between men and women can result in overburdening women with too much work but fewer benefits from the same with negative implications for the family and the whole society (Williams, 2000). This is especially true when women are constrained by inequality and discrimination (van Eerdewijk et al., 2017). Moreover, uneven access to factors of production and unequal distribution of benefits between genders means that aquaculture development does not benefit the whole community as expected (Ndanga et al., 2013). Considering the roles played by women, it is impossible to imagine the aquaculture sector without their incorporation (FAO, 2012).

Weeratunge et al. (2012) and FAO (2013) emphasized the importance of eliminating hurdles limiting women's control over access to assets and gender norms to attain gender equality. Additionally, Schumacher (2014) and Kruijssen et al. (2018) proposed a gender perspective in value chain analysis to mitigate the gender differences in aquaculture and increase production and returns. This entails an assessment of roles performed by men and women, and how they relate with each other; which dictates the possibilities of counteracting constraints and reaping maximum benefits from the venture. This suggestion is envisaged to encourage women's participation in the aquaculture value chain since they complement men for improved productivity and income, as well as promote gender equity (HLPE, 2014). Consequently, addressing inequalities in gender by exposing women to equal access to resources and opportunities like men increases farm production and raises agricultural output which is beneficial to the entire family (Gallant, 2019; FAO, 2011; Weeratunge-Starkloff and Pant, 2011). Since gender equality is enshrined in the Sustainable Development Goal (SDG 5) of the United Nations as a crucial target to be met by 2030 (FAO, 2011), its achievement in agriculture is indispensable (Me-Nsope and Larkins, 2015).

The present study aims to investigate gender roles and constraints in the aquaculture value chain in Western Kenya, a region which registered highest aquaculture production in Kenya. Paradoxically, the region also recorded the highest rates of poverty and malnutrition (Kundu et al., 2016; Ndanga et al., 2013; Obwanga et al., 2018). The study supports the Sustainable Development Goal 2 on zero hunger and Goal 5 on gender equality. In this paper, gender refers to the social-cultural differences among men and women which determine the roles, relationships, and responsibilities, decision making power and access to resources and control over benefits (World Bank, 2012). While applying gender analysis, the study seeks to understand the dynamics and impacts of changes on both men and women and not women's issues alone (Harrison, 1995; Lwenya et al., 2006). It is widely acknowledged that incorporating a gender lens to value chain analysis is indispensable in understanding of men's and women's roles, responsibilities and constraints and increases productivity, economic benefits and quality of livelihoods (Schumacher, 2014; Me-Nsope and Larkins, 2015).

CONCEPTUAL FRAMEWORK

To acquire adequate knowledge on gendered dimensions, this study relied on two analytical approaches that is the rapid assessment approach and the Integrating Gender into Agricultural Value Chains

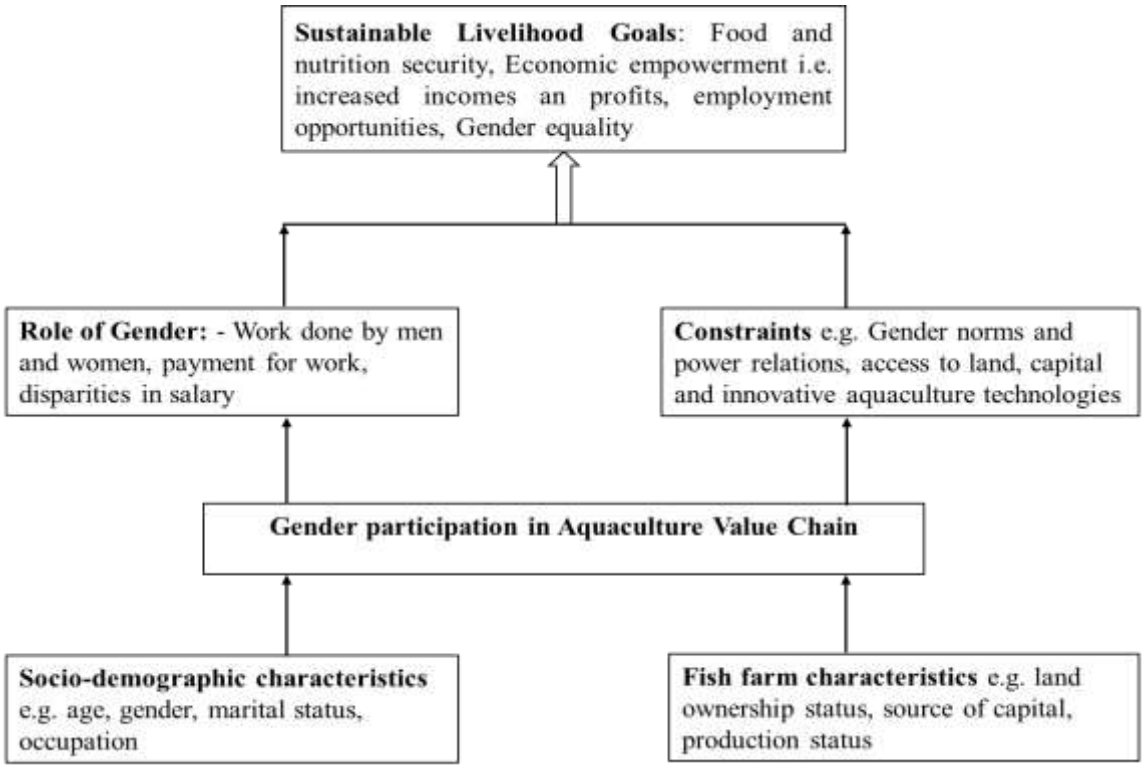

Figure 1. Conceptual framework for gender analysis in the aquaculture value chain.
Source: Modified from Kruijssen et al. (2018).

(INGIA-VC) developed by Rubin et al. (2009). These analytical tools focus on gender roles in agricultural value chains as well as their probable constraints and opportunities. For example, sociodemographic characteristics of farmers influence their roles, constraints and opportunities. Women may face stiffer constraints concerning economic factors of production since most of these factors are controlled by men in their capacity as head of the households. This challenge is also pegged on socio-cultural norms and beliefs which reduces economic options for participation and returns in the aquaculture value chain. Such gender-based differences increase inequality within households, among rural and urban inhabitants and even within countries. Farnworth et al. (2015) noted that women's contribution is rarely considered as primary factors of analysis in the aquaculture sector. Additionally, Ndanga et al. (2013) highlighted that though women participate in aquaculture; their work is mainly considered a traditional responsibility and not accorded any economic value. Coupled with low decision-making power and constraints in power relations within the households, the contribution of women is often unrecognized and unrewarded, which further constrains their productivity. This study, therefore, focuses on integrating gender participation to deliver productivity for both men and women within households.

The variables under consideration are divided into three categories, which are independent variables, intervening variables and dependent variables (Figure 1). Independent variables include the sociodemographic characteristics of fish farmers such as gender, household head and size, education level and occupation. The intervening variable is gender participation in aquaculture which affects both the independent and dependent variable. The dependent variable is gender roles which entails what men and women do in the value chain, gender constraints such as social norms which affect decision making power and benefits. The expected outcome of gender analysis is an understanding of its contribution to increased food and nutrition security among households and economic empowerment.

MATERIALS AND METHODS

This study was conducted in three counties in the Western Kenya region including Kakamega, Kisii and Homa Bay Counties. Survey design and purposive sampling method were employed to select sub-counties in each of the three counties based on fish production statistics. Respondents within each sub-county were randomly selected and a total of 384 farmers were interviewed using structured questionnaires. A reconnaissance survey was undertaken before the actual data collection to assess the type of responses expected from the field. Data were collected at the household level by trained enumerators using a digitized questionnaire in Open Data Kit (ODK), an open-source application

installed on Android mobile phones. The questionnaire solicited information on socio-demographic characteristics of fish farmers, fish farm characteristics, gender roles, responsibilities, relationship, opportunities and constraints in the aquaculture value chain. The data were analysed using Stata version 13 (Stata Corp, College Station, Texas, USA) and statistical significance was considered when $\alpha = 0.05$. Descriptive analyses were done by use of counts, means, median, percentages, standard deviation, and ranges to provide a better understanding of the collected data (Hejase and Hejase, 2013). This study followed the ethical considerations in research surveys involving human subjects (Alcser et al., 2011; Yin, 2009). Prior permission and consent were sought before interviews and the research team protected the rights of free will, privacy and confidentiality of respondents during the interviews and data processing.

RESULTS

Socio-demographic characteristics of the farmers

The mean age of the farmers was 49.3 years with female farmers (44.5 years) being significantly ($p < 0.001$) younger than male farmers (51.5 years) as shown in Table 1. Out of the 384 farmers interviewed, about a third (32%, n=124) were women while men formed two thirds (68%, n=260) of the sampled population. Kakamega County had the highest number of farmers (n=164, 42.7%) followed by Kisii (n=127, 33.1%) and Homa Bay (n=93, 24.2%). There was a significant difference ($p < 0.001$) in the marital status of the farmers with 82.3% being married, 7.8% single, 7.0% widowed and 2.9% separated/divorced. About 32.3% of the farmers had attained primary level of education, 36.7% had attained secondary education and 22.4% were holders of certificate and diploma certificates. A small proportion (6.7%) had an undergraduate degree and only 1% had a postgraduate degree. Forty four percent of the farmers had a household size of 4–6 members, 23.7% had 1–3 members, 27.3% had 7–10 and only 4.9% had more than 10 members. There was a highly significant difference ($p < 0.001$) in the head of the households with more male-headed households (87%) compared to female-headed households (13%).

Fish farm characteristics

The main reasons cited by farmers for venturing into fish farming included: a source of income, food for household consumption, benefit from government, and to create employment opportunities (Table 2). For female-headed households, benefit from government support was highly significant ($p = 0.001$), denoting this as a major reason for entering into fish farming while for male-headed households “creation of employment” was significant ($p = 0.02$). The main source of initial capital for fish farming was personal savings and government support with female-headed households (56%) significantly ($p = 0.011$) depending more on government support as compared to male-headed households (37.1%). More than half of the farmers had inherited land for fish farming (male, 71.2%; female, 60.5%) while the rest had purchased, leased/rented or were squatters. The mean land size utilized for fish farming was 0.21 acres (Standard Deviation, SD=0.22) for female-headed households and 0.28 acres (SD=0.8) for male-headed households but the différences were not significant. The main farmed species were Nile tilapia (female farmers, 95.2%; male farmers, 96.2%) and African catfish (37.9%, 38.9%) respectively, which were not significantly different between the gender. Most of the farmers had earthen ponds, but some owned lined and concrete ponds/tanks.

Gender roles in fish farming

Regarding occupation, 63% of the respondents were farmers, 16.7% were civil servants, 10.9% were traders, 5.2% were artisans, and 4.2% worked in diverse activities. 91.4% of the fish farmers practised fish farming on a part-time basis with 8.6% engaging in fish farming on a full-time basis (Table 3). The main activities performed alongside fish farming was agriculture (67.2%), domestic duties (40.9%), communal duties (37.2%), trading (25.3%), formal jobs (20.1%) and other income-generating activities (3.1%). There was a highly significant difference ($p < 0.001$) in gender performance of domestic duties with more female farmers (63.7%) engaged in domestic duties than male farmers (30%). 93% of farmers were engaged in fish production, 13% in feed production and 7.8% in seed production. There was a significant difference in farmer’s engagement in fish transport and processing ($p = 0.036$), trader and marketing ($p=0.044$) with more female farmers engaged in these activities compared to male farmers. The average annual income from fish farming for female farmers was KES 114,731.40 (SD = KES 102,959.10); while that of male farmers was KES 121,773.40 (SD = KES 159,052.80) but there was no significant difference between male and female farmers’ incomes. This represented 29.9% of the annual fish farm income generated by female farmers compared to 21.1% generated by male farmers which was significant ($p < 0.001$). On the other hand, the average non-fish annual income generated by female farmers was KES 219,164.50 (SD = KES 152,615.50) while that of male farmers was KES 248,607.30 (SD = KES 262,382.70) with no significant difference. Interestingly, female farmers generated 29.2% of non-farm income, while male farmers generated 20.5%; which was significantly different ($p < 0.001$). The benefits accrued from fish farming included fish for family consumption (65%), share of profits (53%), money as a gift (34%) and salary (22%). There were more women (83%) involved in unpaid work than men (17%) with 28% of farmers reporting a disparity in the amount of salary earned for work for both men and women.

Table 1. Sociodemographic characteristics of respondents by gender.

Characteristics	All n (%) n=384	Female n (%) n=124	Male n (%) n=260	p-value
Age				
Mean (SD) age	49.27 (14.09)	44.51 (13.55)	51.54 (13.80)	**<0.001**
County				
Homabay	93 (24.22)	32 (25.81)	61 (23.46)	0.263
Kakamega	164 (42.71)	58 (46.77)	106 (40.77)	
Kisii	127 (33.07	34 (27.42)	93 (35.77)	
Marital status				
Single	30 (7.81)	17 (13.71)	13 (5.00)	**<0.001**
Married	316 (82.29)	82 (66.13)	234 (90.00)	
Separated/ divorced	11 (2.86)	5 (4.03)	6 (2.31)	
Widowed	27 (7.03)	20 (16.13)	7 (2.69)	
Educational level				
Primary	124 (32.29)	42 (33.87)	82 (31.54)	0.729
Secondary	141 (36.72)	48 (38.71)	93 (35.77)	
Certificate/Diploma	86 (22.40)	27 (21.77)	59 (22.69)	
Undergraduate	26 (6.77)	6 (4.84)	20 (7.69)	
Postgraduate	4 (1.04)	0 (0)	4 (1.54)	
Others	3 (0.78)	1 (0.81)	2 (0.77)	
Household size				
1 to 3	91 (23.70)	38 (30.65)	53 (20.38)	**0.042**
4 to 6	169 (44.01)	56 (45.16)	113 (43.46)	
7 to 10	105 (27.34)	27 (21.77)	78 (30.00)	
10 and above	19 (4.95)	3 (2.42)	16 (6.15)	
Head of household				
Mother	50 (13.02)	44 (35.48)	6 (2.31)	**<0.001**
Father	334 (86.98)	80 (64.52)	254 (97.69)	

Gender constraints in fish farming

Norms and perceptions

In terms of social norms, 13.5% of respondents reported the existence of social norms in fish farming concerning what women and men are allowed to do that is in form of labor, who they can interact with and their mobility (Table 4). Almost equal number of female farmers (60.5%) and male farmers (60.8%) reported women to be experiencing mobility challenges due to their domestic engagements. However, there was a highly significant difference ($p < 0.001$) in female (82.9%) compared to male (66%) farmers who reported women to be responsible for food security. In addition, there was a significant difference ($p = 0.001$) in female (37.1%) and male (55.4%) farmers who reported men to be the main income earners. Compared to women, men significantly ($p < 0.001$) made decisions in the management of fish farm enterprises. Among the reasons that hinder women from accessing and benefiting from the aquaculture sector included unbalanced gender norms, power relations, capital, education, and confidence levels. Gender norms ($p=0.020$) and power relations ($p=0.003$) were significant between gender. More male farmers had significantly ($p=0.009$) more control over incomes and profits earned from fish farming as compared to female farmers. Also, male farmers had a highly significant ($p < 0.001$) returns from fish farming as compared to female farmers.

Table 2. The distribution of fish farm characteristics by gender.

Fish farm characteristics	Gender of the respondent			Gender of the household head		
	Female	Male		Female	Male	
	n (%)	n (%)	p-value	n (%)	n (%)	p-value
	n=124	n=260		n=50	n=334	
Reasons for venturing into fish farming						
Source of income	111 (89.52)	241 (92.69)	0.292	45 (90.00)	307 (91.92)	0.648
Food for household consumption	67 (54.03)	139 (53.46)	0.916	27 (54.00)	179 (53.59)	0.957
Government support programmes	46 (37.10)	73(28.08)	**0.020**	18 (36.00)	101 (30.24)	**0.001**
Create employment	50 (40.32)	134 (51.54)	**0.048**	20 (40.00)	164 (49.10)	**0.020**
Others	1 (0.81)	12 (4.62)	0.069	0 (0)	13 (3.89)	0.390
Sthece of initial capital						
Government support	59 (47.58)	93 (35.77)	**0.027**	28 (56.00)	124 (37.13)	**0.011**
Bank loan or microfinance	9 (7.26)	17 (6.54)	0.793	5 (10.00)	21 (6.29)	0.330
Grants from NGO/CBO	23 (18.55)	40 (15.38)	0.434	6 (12.00)	57 (17.07)	0.367
Personal savings	89 (71.77)	192 (73.85)	0.668	33 (66.00)	248 (74.25)	0.219
Friends/relatives	13 (10.48)	27 (10.38)	0.976	4 (8.00)	36 (10.78)	0.549
Others	0 (0)	3 (1.15)	0.554	0 (0)	3 (0.90)	1.000
Land ownership status						
Purchased	36 (29.03)	56 (21.54)	0.114	11 (22.00)	81 (24.25)	0.576
Inheritance	75 (60.48)	185 (71.15)		33 (66.00)	227 (67.96)	
Lease/rent	9 (7.26)	16 (6.15)		5 (10.00)	20 (5.99)	
Squatter	3 (2.42)	1 (0.38)		1 (2.00)	3 (0.90)	
Others (specify)	1 (0.81)	2 (0.77)		0 (0)	3 (0.90)	
Total land area for fish farming, m^2						
Mean (SD)	1315.67 (4937.19)	1001.49 (1420.90)	0.344	867.08 (893.35)	1138.25 (3236.02)	0.557
Fish species produced						
Tilapia	118 (95.16)	250 (96.15)	0.649	50 (100)	318 (95.21)	0.243
Catfish	47 (37.90)	101 (38.85)	0.859	16 (32.00)	132 (39.52)	0.308
Production facilities						
Earthen ponds	102 (82.26)	225 (86.54)	0.270	40 (80.00)	287 (85.93)	0.272
Liner ponds	37 (29.84)	63 (24.23)	0.242	18 (36.00)	82 (24.55)	0.085
Concrete ponds/tanks	9 (7.26)	17 (6.54)	0.793	4 (8.00)	22 (6.59)	0.761

Constraints by access to and control over assets and resources

On the other hand, 52.3% of the male farmers owned the main factors of production for example farm equipment, production facilities and land compared to 36.3% of the female farmers which was significantly different ($p = 0.001$) as presented in Table 5. In addition, there was a highly significant difference ($p < 0.001$) in land ownership, with male farmers (56.9%) owning more land than female farmers (31.5%). More than a quarter of fish farmers sourced capital from friends/relatives (females 29%, males 37%) while the rest accessed capital from microfinance, banks or borrowed from their spouses with more females (16%) depending on their spouses than males (7%). Farmers faced challenges in accessing loan

Table 3. Understanding the distribution of labthe by gender in aquaculture: Roles and perceptions.

Labour division	Overall	Female	Male	p-value
	n (%)	n (%)	n (%)	
Main occupation:				
Civil servant	64 (16.67)	23 (18.55)	41 (15.77)	0.118
Farmer	242 (63.02)	75 (60.48)	167 (64.23)	
Trader	42 (10.94)	17 (13.71)	25 (9.62)	
Artisan	20 (5.21)	2 (1.61)	18 (6.92)	
Other	16 (4.17)	7 (5.65)	9 (3.46)	
Do you work in the fish farm on a full-time or part-time basis?				
Full-time	33 (8.59)	9 (7.26)	24 (9.23)	0.519
Part-time	351 (91.41)	115 (92.74)	236 (90.77)	
What other activities are performed alongside fish farming?				
Domestic duties	157 (40.89)	79 (63.71)	78 (30.00)	**<0.001**
Community duties	143 (37.24)	51 (41.13)	92 (35.38)	0.276
Formal jobs	77 (20.05)	31 (25.00)	46 (17.69)	0.094
Other farm activities	258 (67.19)	78 (62.90)	180 (69.23)	0.217
Trading	97 (25.26)	32 (25.81)	65 (25.00)	0.865
Others	12 (3.13)	2 (1.61)	10 (3.85)	0.351
In which aquaculture sector do you work?				
Feed production	50 (13.02)	18 (14.52)	32 (12.31)	0.548
Seed production	30 (7.81)	10 (8.06)	20 (7.69)	0.899
Fish production	357 (92.97)	117 (94.35)	240 (92.31)	0.463
Transport and Processing	111 (31.09)	45 (38.46)	66 (27.50)	**0.036**
Trader/Marketing	165 (46.22)	63 (53.85)	102 (42.50)	**0.044**
Mean (SD) annual fish farm income	119499.8 (143257.1)	114731.4 (102959.1)	121773.9 (159052.8)	0.653
Percentage generated by women	43.13 (30.34)	69.40 (29.94)	30.60 (21.16)	**<0.001**
Mean (SD) non-farm annual income	239099.7 (232863.8)	219164.5 (152615)	248607.3 (262382.7)	0.247
Percentage generated by women	45.87 (26.51)	63.27 (29.18)	37.58 (20.52)	<0.001
What are women paid for working in the fish farm?				
They get a salary	83 (21.61)	35 (28.23)	48 (18.46)	0.030
They get a share of profits	205 (53.39)	70 (56.45)	135 (51.92)	0.406
They get money as a gift (not regularly)	132 (34.38)	48 (38.71)	84 (32.31)	0.217
They get fish to eat	251 (65.36)	76 (61.29)	175 (67.31)	0.247
Others	3 (0.78)	1 (0.81)	2 (0.77)	1.000
Are more women or more men involved in unpaid work?				
Women	320 (83.33)	111 (89.52)	209 (80.38)	0.025
Men	64 (16.67)	13 (10.48)	51 (19.62)	
Is there a disparity in the amount of salary earned for work by men and women?				
Yes	106 (27.68)	32 (25.81)	74 (28.57)	0.571
No	277 (72.)	92 (74.19)	185 (71.43)	

Table 4. Distribution of perceived gender norms and distribution of benefits by gender.

Characteristics	Overall n (%) n=384	Female n (%) n=124	Male n (%) n=260	p-value
Is there existence of gender norms (in terms of Labour, interaction, and mobility)?				
Yes	52 (13.54)	22 (17.74)	30 (11.54)	0.097
Women's mobility limited compared to men's				
Yes	233 (60.68)	75 (60.48)	158 (60.77)	0.957
Women mainly responsible for food security?				
Yes	252 (71.59)	97 (82.91)	155 (65.96)	<0.001
Are men the main earners				
Yes	190 (49.48)	46 (37.10)	144 (55.38)	0.001
Between men and women, who make more decisions in the fish farm?				
Women	85 (22.14)	63 (50.81)	22 (8.46)	<0.001
Men	299 (77.86)	61 (49.19)	238 (91.54)	
Reason that hamper women from accessing and benefitting from the aquaculture sector?				
Gender norms	124 (32.29)	50 (49.32)	74 (28.46)	0.020
Power relations	200 (52.08)	78 (62.90)	122 (46.92)	0.003
Capital	246 (64.06)	88 (70.97)	158 (60.77)	0.051
Education	146 (38.02)	52 (41.94)	94 (36.15)	0.275
Confidence	168 (43.75)	50 (40.32)	118 (45.38)	0.350
Others	12 (3.13)	4 (3.23)	8 (3.08)	1.000
Do you have control over the income and profits earned from fish farming?				
Yes	337 (87.76)	101 (81.45)	236 (90.77)	0.009
Between men and women who gets more returns from fish farming?				
Women	103 (26.82)	65 (52.42)	38 (14.62)	<0.001
Men	281 (73.18)	59 (47.58)	222 (85.38)	

facilities for fish farming because of repayment challenges and lack of collateral. However, these reasons were not significant between genders. Respondents proposed several mechanisms to promote gender participation in fish farming which included access to aquaculture technologies, best management practices and focus on dissemination of entrepreneurial and technical skills through extension and advisory services.

DISCUSSION

Even though women comprised a third of the fish farmers and were relatively younger than their male counterparts, the majority of the farmers' households were male-headed. The findings corroborate with studies by Obiero et al. (2019), Ole-Moiyoi (2017) and KMAP (2016) recognizing the majority of fish farming households to be male-headed. However, women play a crucial role in the aquaculture industry, since they make a significant contribution at different nodes of the value chain (Ndanga et al., 2013; Weeratunge and Snyder, 2009). In particular, they play a crucial role in the control of production (Brugere and Williams, 2017) and food and nutrition security (Obwanga and Lewo, 2017). However, this trend works against women especially in terms of decision making, benefits sharing and power relations within the households (Kruijssen et al., 2018). Ndanga et al. (2013)

Table 5. Constraints by access to and control over assets and resources.

Characteristics	Gender of the respondent			Gender of household head		
	Female	Male	p-value	Female	Male	p-value
	n (%)	n (%)		n (%)	n (%)	
Ownership of farm equipment and production facilities?						
Yourself	45 (36.29)	136 (52.31)	**0.001**	31 (62.00)	150 (44.91)	0.017
Spouse	16 (12.90)	8 (3.08)		3 (6.00)	21 (6.29)	
Household	59 (47.58)	107 (41.15)		15 (30.00)	151 (45.21)	
Informal group	2 (1.61)	4 (1.54)		1 (2.00)	5 (1.50)	
Institution (school)	2 (1.61)	5 (1.92)		0 (0)	7 (2.10)	
Land ownership						0.174
Yourself	39 (31.45)	148 (56.92)	**<0.001**	30 (60.00)	157 (47.01)	
Spouse	32 (25.81)	7 (2.69)		6 (12.00)	33 (9.88)	
Household	49 (39.52)	95 (36.54)		12 (24.00)	132 (39.52)	
Informal group	3 (2.42)	4 (1.54)		2 (4.00)	5 (1.50)	
Institution	1 (0.81)	6 (2.31)		0 (0)	7 (2.10)	
Source of capital						0.106
Microfinance	30 (21.19)	66 (25.38)	0.034	11 (22.00)	85 (25.45)	
Banks	20 (16.13)	32 (12.31)		9 (18.00)	43 (12.87)	
Friends/Relatives	37 (29.84)	98 (37.69)		24 (48.00)	111 (33.23)	
Borrow from spouse	20 (16.13)	18 (6.92)		4 (8.00)	34 (10.18)	
Others	17 (13.71)	46 (17.69)		2 (4.00)	61 (18.26)	
How easy it is to get a loan for your fish farming business?						0.034
Extremely easy	5 (4.03)	6 (2.31)	0.769	1 (2.00)	10 (2.99)	
Easy	19 (15.32)	40 (15.38)		3 (6.00)	56 (16.77)	
Fairly easy	21 (16.94)	52 (20.00)		6 (12.00)	67 (20.06)	
Difficult	46 (37.10)	102 (39.23)		22 (44.00)	126 (37.72)	
Very difficult	33 (26.61)	60 (23.08)		18 (36.00)	75 (22.46)	
If difficult or very difficult, reasons						0.065
Lack of collateral	44 (35.48)	81 (31.15)	0.397	24 (48.00)	101 (30.24)	
Inability to service the loan	63 (50.81)	113 (43.46)	0.177	30 (60.00)	146 (43.71)	
Other (specify)	6 (4.84)	18 (6.92)	0.430	4 (8.00)	20 (5.99)	
Have access to aquaculture technologies	96 (77.42)	186 (71.54)	0.222	38 (76.00)	244 (73.05)	
Have access to best management practices	90 (72.58)	181 (69.62)	0.551	37 (74.00)	234 (70.06)	
Have access to entrepreneurial and technical skills through extension services	68 (54.84)	141 (54.23)	0.911	28 (56.00)	181 (54.19)	0.012

and Harrison (1995) also echoed the same sentiments noting that men have easier access to productive resources compared to women. Based on broader studies on women engagement in the agricultural value chain, Chete (2019) found a significant contribution of women in the value chain. Results indicate the majority of farmers had primary and secondary level of education, which concurs with Ole-Moiyoi (2017). This gives them basic knowledge on matters related to fish production and marketing. Moreover, they understand the basic information on extension service delivery to update themselves with vital knowledge on technical and entrepreneurial skills (Obiero et al., 2019). Majority of the farmers had a household size of 4-6 members which agrees with a report by KMAP (2016) reporting a similar family size in Kenya. However, this is slightly higher than the 3.9 figure reported in the just concluded census in Kenya (KPHC, 2019).

Overall, most farmers were engaged in fish farming for income generation and food for household consumption which are very important for livelihood improvement (Phillips et al., 2016; Edwards, 2000; Okechi, 2004).

These findings also agree with previous studies by Obiero et al. (2019) and Kiumbuku et al. (2013). Furthermore, results revealed that personal savings and government support were the major sources of capital by both gender with female farmers having a higher reliance on government support. Noteworthy, the dependence on government support for female-headed households might be attributed to constraints of capital sources hindering them from the entry into fish farming. The government initiative through the Economic Stimulus Program (ESP) in the year 2009 to 2012, resulted in an upward and significant growth from 4,218 metric tonnes (MT) in 2006 to a peak of 24,096 in 2014 (Munguti et al., 2017; Obiero et al., 2019). Besides, there was an increase in the value of aquaculture product from Kshs 1.041 billion in 2009 to about Kshs 4.634 billion (US$56 million) in 2012 (SDF, 2012). However, when the support ended, the sector registered a decrease in production to about 14,952 MT in 2016 (KMFRI, 2017). Therefore, the sustainability of aquaculture in the country was challenged after the government support through ESP ended as argued by Amankwah et al. (2016). In this regard, there should be mechanisms by farmers to ensure sustainability and reduce the overdependence on government support.

Furthermore, the present study findings reveal that land was mainly inherited with more male farmers having inherited land compared to their female counterparts. Land inheritance favours the male members and is an old discriminatory tradition and a constraint for women hindering gender equity and productivity. Male headed households had slightly more land than female-headed households which corroborates a study by KMAP (2016) reporting that most of the land for fish farming in Kenya was owned by men. Elsewhere, Ajani (2008) reported that patriarchal arrangements in Nigeria favours men at the expense of women by allocating them more productive land. Sexsmith and Speller (2017) and Chete (2019) posited that women possessed smaller pieces of land compared to men which were attributed to lack of statutory land rights and patriarchal land systems. This societal trend of favouring men as landowners compared to women has been perpetuated over generations in many communities and constitute bias against women. Earthern ponds were the main production units while Nile tilapia was the main cultured species, an observation earlier reported by Munguti et al. (2014), Mucai et al. (2011) and Ngugi et al. (2018).

Farming is the main economic activity of the sampled population, confirming the importance of the agricultural sector in Kenya as essential sources of economic growth, employment, poverty reduction and food security for more than 80 per cent of the Kenyan population (FAO, 2010; UNDP, 2018). Female farmers were mainly engaged in domestic duties characterized by multiple and simultaneous activities within the household which takes much of their productive time as compared to male farmers. Additionally, women were engaged in fish transport, processing and marketing as opposed to men who mainly produced fish yet most of their work was unpaid. This study corroborates findings by Ndanga et al. (2013), Olufayo (2012), Rutaisire et al. (2010) and Lwenya and Abila (2000), Abila et al. (2009) and Ikiara (1999). The significant contribution of women is important, especially when examining the effect of gender relations on aquaculture production since it is impossible to imagine the aquaculture sector without women especially on the terminal end of the value chain (Harrison, 2000).

Ndanga et al. (2013) demonstrated that though women are actively involved in different nodes of the aquaculture value chain, much of their work is unpaid and unrecognized and mostly assumed to be an extension of domestic duties. Their active participation geared towards improving food and nutrition security and economic wellbeing of households (Lewis, 1997; Edwards, 2000; Genschick et al., 2018) cannot be overemphasized. Therefore, failure to remunerate women for their productive roles is not just subordinative but diminishes productivity, compromises production and circumscribes sustainable livelihoods (Chete, 2019). To achieve economic growth and food security, women efforts have to be fully recognized and rewarded which requires concerted efforts and support at the household, community and national level. The implementation of ESP spurred aquaculture growth in Kenya (Nyandat and Owiti, 2013) presenting many opportunities under the prevalent growth strategies for women to participate in aquaculture (Ndanga et al., 2013). The results are consistent with Cohen et al. (2016) who found that women's labour demands continued to escalate as livelihood activities diversify. Additionally, de Haas (2009) noted that changes in gender roles among households are correlated with improved livelihood pursuits.

Female and male respondents agreed that there were social norms, interaction and mobility challenges which mainly affected women and were associated with domestic responsibilities. As such, women capacity to pursue a broader range of livelihood activities and to attend training was limited by physical mobility restraints. The same sentiments were echoed by Lawless et al. (2019) who noted serious gender norms restricting women from leaving the households in the Solomon Islands since their husbands could not undertake domestic duties because it was against customary expectations. Also, this was a way of challenging existing power relations and a high form of disrespect for their husbands (Boudet et al., 2013) and could increase tension in relationships. Family responsibilities reduce women availability in meetings and limit their participation as they carry out other domestic activities. Gender equity in aquaculture can be enhanced through engaging both men and women in a gender transformative approach entailing shifting inequitable norm-based constraints which hinder full participation, production and benefits.

Access to factors of production for example land was a greater constraint for women than for men and this, in turn, limited women's ability to access loan because they lacked collateral and financial leverage. This is a double tragedy and hinders women capacity to improve productivity geared towards better livelihoods and development (KIT, Agri-ProFocus, IIRR, 2012; Ndanga et al., 2013; Harrison, 1995). In many communities, land inheritance is tagged to discriminatory laws and patriarchal land systems (Sexsmith and Speller, 2017) which labour men at the expense of women. For example, women own about 10-30 % of land in Africa, about 10% in Ghana, and a meagre 5% in Mali and Kenya (Doss, 2005; Deere and Doss, 2006; Chete, 2019). In Pakistan, Ecuador and Bangladesh women-headed households control smaller portions of land compared to male-headed households (FAO, 2011). Brugere and Williams (2017) and Kiumbuku et al. (2013) postulated that constraints to factors of production which are associated with gender norms limit women engagement in aquaculture with negative implication to food and nutrition security. Evidence by Ajani (2008) highlighted that patriarchal arrangements allocate bigger and more productive land to men denying women of commensurate access which is discriminatory. Moreover, Gilbert et al. (2002) and Holden et al. (2001) posit this trend to be leading to lower yields and as a result unproductive. The major constraints experienced by farmers are common in the agricultural sector as reported by Veliu et al. (2009) and Me-Nsope and Larkins (2015).

Therefore, increasing women's access to factors of production could optimize production by 20–30 per cent and raise output in developing countries by 2.5–4 per cent and at the same time reduce the number of hungry people in the world by 12–17 per cent (Peterman et al., 2010; FAO, 2010). Consequently, enhanced gender participation in aquaculture, among other issues highlighted by (FAO, 2012) could promote equitable access to and control over resources which is salient in addressing SDG 2 and SDG 5 on reducing hunger and ensuring gender equality for holistic development. This is in line with studies by Weeratunge et al. (2010) that reported a direct link between gender equity and social and economic growth.

Women also faced a challenge in accessing entrepreneurial skills and education which was associated with challenges of mobility and gender inequality as reported by Kruijssen et al. (2018). A study by the World Bank (2012) and UNDP (2018) highlighted that such gender inequality and discrimination negatively affects production and development outcomes and social wellbeing of not only women but the entire household and community at large. There is a correlation between gender inequality and increased poverty levels, poor economic growth and social wellbeing (Weeratunge et al., 2010). Besides, Gallant (2019) reported that gender norms negatively affect the decision making of women within households, increasing the burdens and reducing benefits accrued from farming.

Male farmers had more control over incomes and profits earned from fish farming as compared to female farmers. This agrees with findings by Gallant (2019), Ndanga et al. (2013) and Kruijssen et al. (2013) who noted that the benefits from fish farming are not equally accessible or distributed to the men and women who engage and depend on it. Access to credit facilities could result in significant improvements within households thereby positively influence productivity and improving livelihoods. Several authors found a positive relationship between microcredit and women's decision-making power within households and control over assets (Amin et al., 1995; Jamal, 2008) and women empowerment (Mayoux, 2006, Malhotra et al., 2002) and power relations within the households (Mizan, 1993; Kabeer, 2001). Chete (2019) noted that gender inequality in agriculture is mostly manifested in access to and control over resources and benefits. However, this study found no discrimination between the income earned for work between men and women. This study contributes to gender awareness of roles and opportunities along the aquaculture value chain. The authors recommend similar studies to be conducted in other parts of the country.

Conclusion

Both women and men's complementary roles were evident in the aquaculture value chain and production, transport and marketing. Women contribution was significant, though their representation was low as compared to their male counterparts and most of their work was unpaid. Moreover, women faced constraints associated to access to factors of production, control over income and benefits, gender norms, and mobility. Therefore, providing women with more access to factors of production and abolishing discriminatory norms and relations limiting optimum participation and benefits will raise aquaculture output, development outcomes and social wellbeing of not only women but the entire household, community and the nation at large. This is also imperative in releasing SGD 2 on zero hunger and SGD 5 on gender equality for holistic development taking in to account the link between gender equity and social and economic growth.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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