Original Research Article

SURVEY ON THE HALAL GOAT PRODUCTION SYSTEM IN THE PROVINCE OF MAGUINDANAO, BANGSAMORO (BARMM), PHILIPPINES

ABSTRACT

The study was conducted to characterize the existing Halal goat production system in the province of Maguindanao and compare the farmers' management practices with the existing Japan International Cooperation Agency (JICA) standards and Philippine Council for Agriculture, Aquatic Resources Research and Development (PCAARRD) protocols in Halal goat raising. The study reveals that the respondents' practices in goat raising at Parang, Maguindanao are not significantly different from the Japan International Cooperation Agency - Autonomous Region in Muslim Mindanao (JICA-ARMM) goat production and management standards as well as PCAARRD Halal goat production protocol except for the location of the goat house. The study proved that farmers' practice in goat raising has similarities with JICA and PCAARRD protocols except for some aspect such as location of the house, use of commercial and synthetic drugs in vaccination and disease treatments and feeds and feeding. The JICA protocol on housing location is different from the actual practice of farmer respondents and PCAARRD protocol. Farmers are not knowledgeable in the feeding value of combine grass-legume to the goat. Under intensive feeding management, legume-grass combination is a better option in profitable goat raising. In terms of housing, farmers do not practice standard designs such as elevated flooring, floor space requirements and required distances between flooring and ceiling and between the ground and flooring as what PCAARRD and JICA protocol recommended.

Keywords. PCAARRD, JICA, ARMM, Halal, Shariah, Wholesomeness

INTRODUCTION

In the recent years, Muslims have become increasingly concerned about the meat they eat. Proper product description is very crucial for consumers to make informed choices and to ensure fair trade, particularly in the ever growing halal food market. Globally, Muslim consumers are concerned about a number of issues concerning meat and meat products such as pork substitution, undeclared blood plasma, use of prohibited ingredients, pork intestine casings and non-halal methods of slaughter (Sanchez et. al., 2020).

The Halal goat production program in the province of Maguindanao is an offshoot of the national and regional agenda to jumpstart the Halal development industry in the country. The Department of Agriculture - Maguindanao initiated the program through goat dispersal in the selected municipalities. Twenty-two (22) heads of breeder native goats were dispersed to qualified beneficiary-cooperatives and re-dispersal is progressing to the neighboring communities. Through this initiative, the ARMM region is anticipated to be the Halal hub of the country and one of the key players in the global Halal market in the future. Although the per capita consumption is only 0.21 kg per year, Halal goats are commonly used by Muslims as a sacrifice in the

observance of their faith especially during religious occasions such as Kanduli, Aqiqah, Ramadan, Eidl al-Fitr and Eidl al-adha which increase local demands for such commodity during these times. Currently, Halal goat production in the region is still starting wherein farmers have limited knowledge of its various aspects (Navarra, G.A, et. al., 2019).

Goat raising remains a least prioritized agricultural enterprise in Maguindanao despite its agro-climatic edge and being a Muslim dominated province because of lower awareness about Halal goat production. The Halal-compliant goat production as a program of the government is a new concept among Muslim and non-Muslim communities. Consumer demand for Halal-compliant goats and its by-product is low, local marketing system is not standardized resulting to proliferation of price monopoly and intervention of intermediaries along the marketing channel.

In the Philippines Halal-compliant food production and marketing is led by BARMM region where Muslim population is concentrated. The region also has the institutionalized Halal certification, Halal auditing, Halal Diagnostic and Halal labelling system that started way back 2008 (Paola, J. D. 2012). As a commitment to pursue and develop Halal production in the country, the Philippine government supported the initiative thru institutionalization of Philippine National Standards and mainstreaming Halal programs in the Department of Agriculture. The country is now pushing Halal industry as a global competitive enterprise. In fact, on February 2018, the Department of Agriculture launched the Halal Food Industry Development Program as one of the banner program of the Department. To jumpstart the program, a national Halal roadmap, executive committee and technical working group was created.

Halal goat research in the Philippines started in 2010 wherein protocols on Halal goat production and quality assurance system have been established (Ambali and Bakar, 2014). Halal goats are only allowed to graze a clean pasture, free from anything considered unlawful with Muslim shepherd for at least 2 hours per day. Tethering and stall- feeding or full confinement are also allowed. Vaccination, deworming and vitamins are allowed as part of goat health management practices (PCAARRD, 2015).

Most popular forage grasses cultivated include napier (*Pennisetum*), *Brachiaria* and *Panicum* species. Although there are similarities, species of forages grown and cultivated in any country and region varies depending on climate and livestock needs (Salvaña, F. R. P., et.al., 2019.). In other municipalities of Mindanao, goat raisers utilized available plant species within spaces of crop plantations. Goats are allowed in the crop plantation and consume weeds without damaging the crops. These weeds grow together with planted crops like oil palm and papaya. Perennial crop plantations also house different species of plants that can be utilized as feed for livestock (Speedy and Pugliese, 1992).

Most farmers prefer rice and corn farming to goat raising because of its immediate returns and less inputs. Farmers seldom plant quality forages. In fact, very few goat raisers grow improved grasses and legumes for their animal. Instead, they are dependent only on natural pastures and traditional management practices. Farmers also have limited information on the Halal-compliant and conventional way of raising goats. Therefore, it is eyed that continuous research in this endeavor is necessary to increase awareness of the Muslim and non-Muslim communities on Halal goat production as a viable enterprise.

In the Bangsamoro Autonomous Region in Muslim Mindanao a subsequent regional Halal roadmap was consequently done. The roadmap became a guiding tool of the then Department of Agriculture – Maguindanao in starting up Halal goat production project. The salient features of the project includes dispersal of 22-does to qualified farmer-beneficiary, technical know-how training on Halal goat production. The Department closely monitored the implementation of the project.

MATERIALS AND METHODS

A semi-structured survey questionnaire was developed and administered among ninety (90) Halal goat farmers from 11 cooperatives in the municipality of Parang, Maguindanao province. The province is located in Mindanao, a third largest island of the Philippines. Maguindanao province is predominated by Tri-people: Muslims, Christians and High Landers, but the former is the majority tribe in the province.

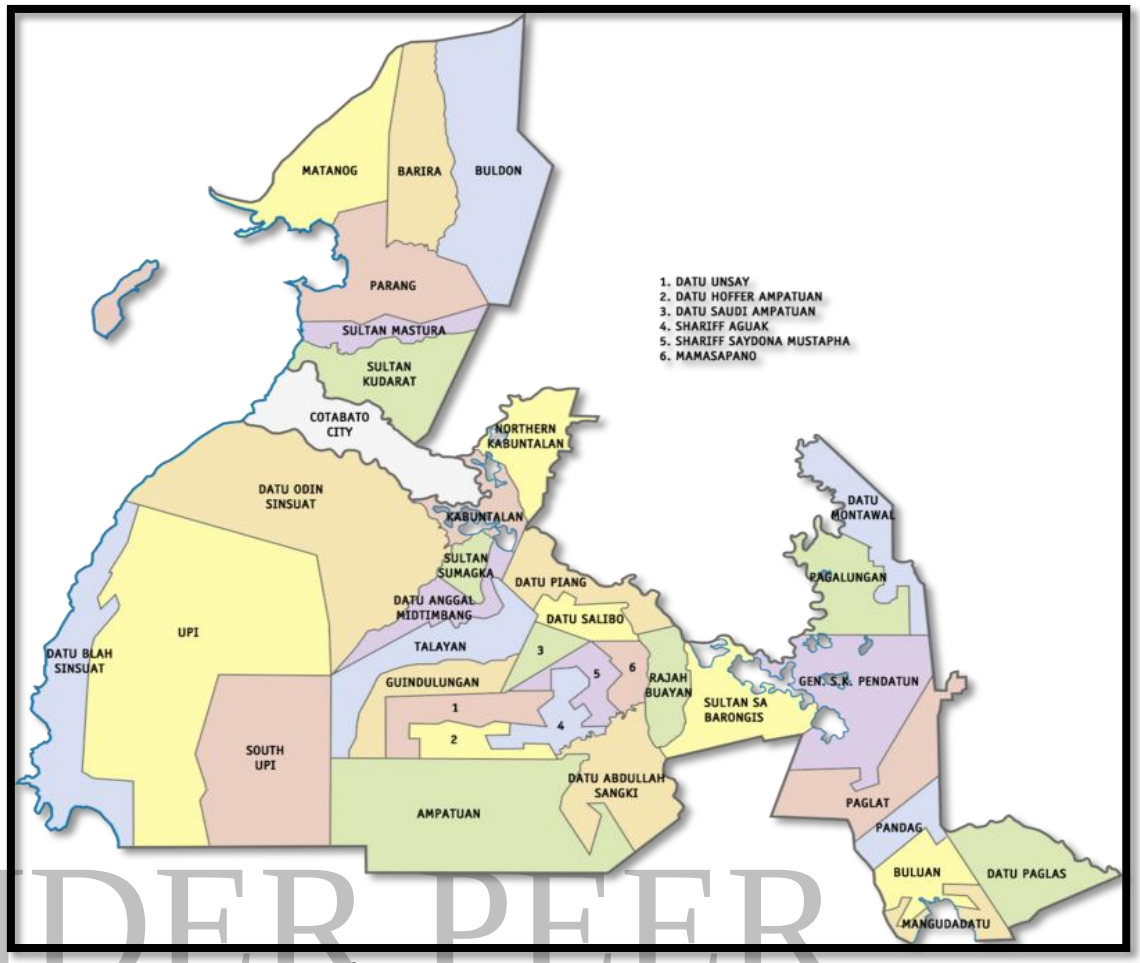

Figure 1. Location map of Maguindanao province in the Mindanao island, Philippines.

The province lies within 7 degrees and 40 minutes north latitude and 123 degrees and 15 minutes east longitude. It is located 584 aerial kilometers away from the City of Manila. It is bounded on the northeast by the Province of Cotabato, on the northwest by the Province of Lanao del Sur, on the southern part by Sultan Kudarat, and on the western part by Moro Gulf.

The respondents of this study were selected goat raisers of Maguindanao province. These farmers were recipients of the Halal goat dispersal program of the Department of Agriculture-Maguindanao. They were randomly selected as respondents based on the four guidelines set by JICA as follows: 1) proximity of the farm to the source of parent stocks, 2) have at least 0.5 to 1.0 ha forage/pasture areas, 3) hilly to sloping pasture areas, 4) with existing facilities such as low-cost goat barn and fencing, and 5) underwent JICA training on goat production and management.

The study was conducted in February to April, 2016 at the municipality of Parang, Maguindanao province using 18 heads meat-type Philippine native goats breed. The experimental goats were stall-fed for three (3) months duration adopting a Completely Randomized Design (CRD) experimental design. Goats were fed with a combination of grass and legumes such as Napier grass and Ipil-Ipil

A 100 percent retrieval of completed questionnaires was achieved. Data obtained were tabulated and analyzed using descriptive statistics.

RESULTS AND DISCUSSION

Technical Knowledge of the Respondents in Goat Raising

All farmer-respondents are technically knowledgeable in the field of goat raising because they were trained by Japan International Cooperation Agency - Autonomous Region in Muslim Mindanao (JICA-ARMM) and Department of Agriculture - Autonomous Region in Muslim Mindanao (DA-ARMM) on goat production and management for three consecutive months. They were supported by the JICA in terms of funding and logistics. In fact, 96% of the respondent claimed that they have prior knowledge on Halal goat production system long before the formal launching of the Halal Goat Program.

Breeding and reproduction in goats. The Department of Agriculture-Maguindanao launched the Halal goat program in 2008, in which it was piloted at the municipality of Parang, Maguindanao on 2013. The respondents admitted that Halal goat program was popularized in the municipality in 2013 after it was launched on 2008. The goats used by the respondents are provided by the Department of Agriculture with a condition to sustain the program. This is the reason why most of the respondents are aware of the Halal program of the Department of Agriculture. The most reliable and effective methods of breeding in goat is the natural mating (NORTON, B, W, 2006). Also in halal goat system, artificial insemination is not permitted as it is the alteration of natural phenomena (Ambali, A.R. and Bakar, A.N., 2014).

The survey also reveals that the father is the most responsible person in the family in taking care of goat (72%). However, in the absence of the father, the son assists in herding the goat. This practice is commonly seen in the remote villages of Maguindanao. Their daily farm activities are divided into three: 1) 4 hours for tethering the goat, 2) 2 hours for cleaning the goat house, and 3) 2 hours for cutting grasses and legumes. It is also stated in the survey conducted by Salvañ, F. R. P., 2019 that fathers and sons of the household members are the one primarily taking care of goat herd in most remote communities.

Ambali and Bakar (2014) also observed that tethering is rampant in areas where there is unfavourable peace and order situation. Tethering was done from 9:00 am to 1:00 pm, after which the goat is driven into their houses and provide roughages throughout the night. Cleaning was done to prevent bacteria and parasite contamination to the goat. These management practices in goat conformed to the standard of Department of Science and Technology - Philippine Council for Agriculture, Aquaculture Resources Research and Development (DOST- PCAARRD) and Japan International Cooperation Agency (JICA-ARMM).

Farmer-respondents used upgraded native goats in starting their Halal goat farming. According to the 96% of the farmer-respondents, the best consideration in selecting a breeder doe is its mothering ability. This is the ability of the mother to nourish their kids specially, during the neonatal or suckling period. In the Halal production protocol adopted by the JICA and PCAARRD, local breed produced thru natural mating must be used as starter stock. Pure native

goats or its upgrades are more adoptable to harsh and variable agro-climatic conditions according to Norton (2006).

Less than 50% of the respondents revealed that they prefer a horned goat to the aggressive one because in the Islamic point of view only horned goats can be qualified as sacrificial animal for religious offerings. The approved protocol also recommended horned goats to be used in goat raising as they comply with the preference of Muslim cultures and Shariáh Laws.

On the other hand, majority of respondents (82%) believed that health is the primary considerations in stock selection. Healthy goat can be observed in the coat, eyes, posture, body condition score (BCS), manure, and mobility. They also claimed that natural mating is better and more realistic than artificial breeding under Parang condition. They believed that natural mating is cost-effective and feasible because it does not require technical expertise and scientific manipulations. In natural breeding, the doe is brought to the buck and let the buck mount the does. Both the JICA and PCAARRD protocol agrees on these standards.

According to PCAARRD 2015, a healthy breeder goat has smooth and shiny hair coat, active, ruminating, no signs of lameness, bright eye pupil, with moist in the muzzle, has normal manure and no body defects. Furthermore, goats with illnesses and body defects such as unilateral cryptorchid cannot be used as breeder.

Furthermore, the respondents agreed that the ideal breeding age for does is between 7-8 months old and 8-9 months, respectively. This knowledge coincided with the standards set by the JICA and PCAARRD Halal production protocol (Table 1). The buck power can be attained when buck reached 1-year-old (Noble, 2004). At this age, he can service more than 10 does at a time for one month. They also said that goat's pregnancy would last for 5 months with an allowance of 5 days in which under normal condition and good nutrition, the duration of pregnancy is more or less 150 days. On the issue of estrus cycle all respondents believed that when goats reached puberty age of 7-8 months the heat (estrus) occurs every 21 days.

On the other hand, 95% of the respondents believed that a mature buck serviced more or less 25 does. Under normal condition, a mature buck can mate more than 20 heads does in pasture mating. This observation agreed with the JICA and PCAARRD protocol.

About 67% of the respondents also revealed, that in hand mating the buck is brought to the in heat does and allowed to mount. They believed that putting bucks and does together in one pen would result to unsystematic breeding or inbreeding. This practice also conformed to the two protocols presented in Table 2.

On breeding and reproduction, most of the farmers' practices are similar or in conformity with the protocols set by JICA-ARMM and DOST-PCAARRD. They only differ in the use of breed for the initial stock in that JICA-ARMM suggested local strains because they are readily available in the locality. On the other hand, PCAARRD and survey respondents preferred upgraded or crossbred because accordingly they carried the potential traits of their parents.

Table 1. Technical knowledge of respondents on goat breeding and reproduction.

CRITERIA	FRE-QUENCY	PERCENT
Breeds of goat use as initial stock:		
Upgrades	90	100
Criteria in selecting a breeder doe:		
With good mouth, normal genitals and large udder	4	4
Good mothering ability	86	96
Total	90	100
Criteria in selecting a breeder buck:		
Aggressive	36	40
With Horn	49	54
Big and balance scrotum	5	6
Total	90	100
Preferred characteristics of goat:		
Young	15	17
Healthy	74	82
Active	1	1
Total	90	100
Knowledgeable in breeding goat:		
Yes	90	100
Method of breeding the goat:		
Natural Mating	90	100
Ideal Breeding age for does:		
6-7 months old	34	38
7-8 months old	56	62
Total	90	100
Ideal breeding age for bucks:		
7-8 months old	2	2

8-9 months old	88	98
Total	90	100
Knowledgeable on reproductive traits		
YES	90	100
Gestation period of goat:		
150 plus/minus 5 days	90	100
Estrus cycle of goat:		
21 days average	90	100
Duration of estrus in goat:		
18 hours average	90	100
Ideal mating ratio of mature buck:		
1 male is to 15 females	1	1
1 male is to 20 females	4	4
1 male is to 25 females	85	95
Total	90	100
Method of mating halal goats:		
Bring the doe to the buck	29	32
Bring the buck to the doe	60	67
Put them together in one pen	1	1
Total	90	100

Table 2. Comparison of farmers' practices, JICA and PCAARRD protocols on breeding and reproduction of Halal goat.

OBSERVATION	JICA PROTOCOL	PCAARRD PROTOCOL	COMPARISON WITH FAMERS PRACTICE
Breeds of goat use as initial stock	Local Strains	Upgraded/Crossbred	Same with PCAARRD
Criteria in selecting a breeder doe	a. With good body conditions b. Good mothering ability	a. With good body conditions b. Good mothering ability	Different with PCAARRD and JICA because farmers preferred good mothering

			ability
Criteria in selecting a breeder buck	a. Aggressive b. With horn	With horn	Same with PCAARRD
Preferred characteristics of goat	a. Young b. Healthy c. Active	Healthy	Same with JICA and PCAARRD
Method of breeding the goat	Natural mating	Natural Mating	Same with the two protocols
Ideal Breeding age for does	8 months old	8 months old	Same with the two protocols
Ideal breeding age for bucks	9-12 months old	9-12 months old	Same with the two protocols
Duration of estrus in goat	24-40 hours	18 hours	Same with JICA protocols
Ideal mating ratio of mature buck	1 buck : 25 does	1 buck : 25 does	Same with the two protocols
Method of mating halal goats	Bringing the doe to the buck	Bringing the doe to the buck	Same with the two protocols

Management of lactating does and newly born kids. A newly born kid must suck the colostrums according to all respondents interviewed (PCAARRD 2015). Because colostrums is the first milk containing antibodies good for the kid's health. In fact, they concluded that kids that cannot suckle colostrums must be fed with whole or skim milk as a substitute. According to JICA and PCAARRD, neonates must suckle the colostrums of the mother.

In the survey, 71% of the respondents said that growing kids about 4 months old must be separated from the mother because this will allow the animal to acclimatise to its environment and the mother would return to normal heat cycle (Table 3). This observation is in conformity with the protocol of DOST-PCAARRD. Some respondents also said that growing kids must be put in a separate pen instead of separating them from the mother. Putting the kids visible to the mother will not break the bond of mothering behavior. JICA standards agree on this observation.

Table 3. Management practices for lactating does and newborn kids.

CRITERIA	FREQUENCY	PERCENT

Management practices for growing kids:		
Separate them from mother	64	71
Provide them separate pens	26	29
Total	90	100
Method of caring pregnant does:		
Separate them from the non- pregnant	89	99
Mix them with the rest of the herd	1	1
Total	90	100
Method of caring for newly born kids:		
Allow them to suckle colostrums	90	100
Identification marks:		
Ear notching	35	39
Neck chains	55	61
Total	90	100
Do you practice castration?		
No	90	100
Reasons for not practicing castration:		
It is not permitted	90	100
Care for weanlings:		
Separate kids from the mother at 3-4 months old	90	100
Care for the lactating does		
Let kid suckle the milk	90	100
Do you practice farm recording?		
Yes	86	96
No	4	4
Total	90	100
Do you practice selection and culling?		
Yes	90	100
Total	90	100

Management practices for the breeder bucks:		
Provide separate pens	60	67
Provide good quality roughages	30	33
Total	90	100

On the other hand, 99% of the respondents revealed that pregnant does must be isolated and put in a separate pen otherwise developing fetus will be aborted due to cannibalism. In addition, they said that pregnant does have different nutritional requirement from the non-pregnant ones and the rest of the herd. It is likewise important to provide them excellent nutrition in preparation for lactation. Standards set by JICA and PCAARRD on how to manage pregnant does are shown in Table 4.

Pregnant does must be isolated from the rest of the herd to prevent miscarriage or abortion cause by cannibalism, especially when mixed with bucks (Asheim, et.al., 2013). Also during lactation bucks must be separated from the pregnant does or dry does to prevent transfer of goaty smell to the milk when it is used in dairy processing.

Table 4. Comparison of farmer's practices, JICA and PCAARRD protocols on management for lactating does and newborn kids.

OBSERVATION	JICA PROTOCOL	PCAARRD PROTOCOL	COMPARISON WITH FARMER'S PRACTICES
Management of growing kids	Separate them from mother Provide them separate pens	Separate them from mother	Same with the two protocols
Methods of caring pregnant does	Separate from the non-pregnant	Separate from the non-pregnant	Same with the two protocols
Methods of caring newborn kids	Allow them to suck colostrums	Allow them to suck colostrums	Same with the two protocols
Identification marks used	Ear tag and neck chains	Neck chains	Same with PCAARRD protocol
Practice of castration	No	No	Same with the two protocols
Reasons for not practicing castration	Not recommended in Halal standard	Not recommended in Halal protocol	Same with JICA and PCAARRD protocols

Care for weanlings	Separate kids from the mother at 3-4 months old	Separate kids from the mother at 3-4 months old	Same with two protocols
Care for the lactating does	Let kid suckle the milk	Let kid suckle the milk	Same with PCAARRD and JICA protocols
Practice of farm recording	Yes	Yes	Same with the two protocols
Practice of Selection and culling	Yes	Yes	Same with the two protocols
Management of breeder bucks	Provide separate pens and good quality roughages	Provide separate pens and good quality roughages	Same with two protocols
Record keeping	Yes	Yes	Same with JICA and PCAARRD protocols

The two protocols and farmers' practices agreed in all observations for the care and management of the lactating does and newborn kids.

Dehorning and castration of goat. All farmer-respondents completely ignored castration of the bucks. According to them, castration is not included in the protocols of Halal goat production system basically, because it is not permitted by Islamic ways. Like horned goats, Islam preferred uncastrated ones as sacrificial animals for religious festivities and offerings. This claim is supported by both JICA and PCAARRD protocol.

Contrary to religious beliefs, most studies confirmed that pooled (dehorned) goats are more docile than the horned ones. Meanwhile, castrated bucks have less male odor caused by testosterone hormone than the castrated ones. Castrated male goats are observed to grow faster than the uncastrated ones because they utilize less energy in running or mating with the does.

The Department of Agriculture-Maguindanao in partnership with JICA ARMM and USM local consultants trained 19 cooperatives in Maguindanao for three (3) consecutive months. The training was focused on the goat production and management with emphasis on Halal concept. Topics discussed were: 1) stock selection, 2) site selection, 3) feeds and feeding, 4) production system, and 5) health management.

Similar to castration majority of the respondents said they did not dehorn their goats because it is the preference of Islamic views and besides it is stipulated in the Halal goat production protocol developed by PCAARRD.

Management of the Weanling

All the respondents said that kids at 3-4 months old must be gradually separated from the mother and allow them to accustom in the young forages. This will offer two advantages: 1) it allows the mother to cease milk production and commence the estrus cycle and breeding activity, and 2) it allows the weanlings to run with rest of the herd in the pasture and accustom themselves in pasture grazing. Gradual introduction of weanlings to the pasture also allows full development of digestive tract and rumen microflora.

Furthermore, all of the respondents believed that the kids must suckle the milk of lactating mother until weaning. Milk from the mother contains complete set of nutrients required for the normal growth of tissues and body functions, particularly for the growing kids. Suckling also regulates production and secretion of milk hormones like prolactin. Hence, it prevents occurrence of mastitis in the mother. This is also emphasized in the JICA and PCAARRD protocols of Halal goat management.

On the other hand, good quality breeders can be obtained thru selection and culling according to the majority of respondents interviewed. Most of the registered goat farms have institutionalized this practice to maintain genetic potentials and merits of their stocks. Selection and culling is also emphasized by JICA and PCAARRD protocols to separate desirable from undesirable one.

Record keeping is a quality assurance guarantee according to 86 respondents. Record must contained relevant information on production and health. Recording will not only facilitate animal identification but also promote farm recognition. The credibility of the farms to the clienteles and costumers depends of how updated is the farm record and the quality of the stocks being maintain. This is also one of the management practices emphasized by JICA as well as PCAARRD in order to maintain farm credibility.

Management of the Breeder Bucks

Breeder bucks must be provided with separate pens within the house to regulate mating and facilitate breeding activities according to the 60 respondents. They also suggested that bucks must be provided with good quality roughages to maintain its prolificacy.

Housing and Fencing

All the respondents said that halal goats' house must be provided and constructed in a well-drained area, which is free of stray animals such as dogs, cats and other predators. They also emphasized that the presence of predators could harm and intimidate the goats that may cause bruises, injuries and stress. Close contact between the filth and goats must be avoided to preserve its Halalness and wholesomeness. This claim is conforming to the standard set by PCAARRD stating that goat house must be constructed away from toilets, piggery and canals.

They also claimed that Halal goat house need not be expensive. In fact, according to them low-cost housing with elevated flooring is a practical option for a marginal goat farmer. Most of the backyard-type goat farms in Maguindanao province are made of low-cost housing materials such as round timber and bamboo (Table 4). The municipality of Parang is a home of good timbers grown almost anywhere. JICA and PCAARRD also supported this proposition (Table 5).

On the other hand, the respondents unanimously agreed that the ideal floor space requirements for breeder doe, buck and young goats are approximately 1.5, 2.0 and 1.0 square meters, respectively to allow free movement within the pen. Furthermore, they justified that goat feels convenient if they can move freely inside their cages. Goats feel uncomfortable when movement is restricted. In compliance with animal welfare provisions, animals must be provided enough space to feel comfort all day round.

Loafing area is necessary for a goat according to all respondents interviewed. This is so because goats in nature are social animal (Andersen and Boe, 2007). Furthermore, respondents said that loafing area was provided for security purposes and as roaming area where goats can mingle and enjoy.

Pasture areas also must be fenced to secure goats from stray animals and other predators and also it will prevent overgrazing. If pasture is properly fenced, goats cannot graze outside that might endanger them from acquiring diseases. Fence will also facilitate pasture/grazing rotation. Issues on fencing the pastures and loafing area is supported by both JICA and PCAARRD.

Table 5. Comparison of farmers practices, JICA and PCAARRD protocols on housing and fencing of Halal goat.

OBSERVATION	JICA PROTOCOL	PCAARRD PROTOCOL	COMPARISON WITH FARMER PRACTICES
Provision of housing and its location	Housing must be constructed in a well-drained area	1. Far from piggery farm, canals and toilet 2. In a sloppy area	Same with PCAARRD protocol
Reasons for housing the goat	For security purposes	Prevent cross contamination from Haram sources.	Same with PCAARRD protocol
Type of housing	Low cost with elevated flooring	Low cost with elevated flooring	Same with the two protocols
Floor space for does	1.5 sqm/head	1.5 sqm/head	Same with the two protocols
Floor space for bucks	2.0 sqm/head	2.0 sqm/head	Same with the two protocols

Floor space for the kids	1.0 sqm/head	1.0 sqm/head	Same with the two protocols
Provisions of loafing area	Yes	Yes	Same with the two protocols
Reasons	For convenient purposes	For convenient purposes	Same with the two protocols
Fencing the pasture/loafing area	Yes	Yes	Same with the two protocols
Reasons for fencing	Security purposes	Prevent entry of dogs and other predators	Same with PCAARRD protocol
Fencing materials used	Round timber and barbed wire	Low-cost materials	Same with PCAARRD protocols

Moreover, respondents used round timber and barbed wire as fence for their pastures because according to them, these are readily available in their locality and they are cheap and affordable. Round timber and bamboo slots are very common construction materials for house and other livestock facilities in Maguindanao province.

Farmer's practice for the location of the goat house is the same with the protocol suggested by PCAARRD. Goat house must be constructed in areas free of filth to prevent cross contamination. Likewise, in fencing PCAARRD and farmer-respondents agreed on the use of low-cost material that would not add cost to the small goat raisers.

Feeds and Feeding in Goat

All of the respondents have a pasture area allotted for their goats. Fifty-two percent (52%) have an area of 0.5 hectare while the rest owned 1.0 hectare. Feeds and feeding comprised about 70% of the total livestock production cost. Forage and pasture establishment is a requisite to sustainable ruminant production. Goats as ruminant are more productive and can thrive best in roughages than concentrate feeds.

Grasses such as Guinea are the most abundant roughages in the area of 67% farmer-respondents and leguminous shrubs such as kakawate (or madre de cacao) for the 33% respondents interviewed. Specifically, guinea grass, kakawate and ipil-ipil are commonly found elsewhere in the interior part of the municipality. They just grow along the hedgerows, pathways, paddies and open areas. The JICA technical experts and PCAARRD experts' recommends feeding the goat with grasses and leguminous shrubs if they are readily available in the locality.

In the separate study conducted by Sanchez, et. al (2020), they discovered that most of the goat raisers in region XII utilized both indigenous species of grasses in combination with improved species in feeding their goats. Although goats are selective in feeding, they also prefer fibrous species of grasses, legumes and leguminous shrubs.

All respondents did not supplement commercial concentrate to their goats because accordingly it only adds cost to the production. Those who wanted to supplement concentrate said that it is required for the normal growth and maintenance of goats, while those who refused to supplement also claimed that commercial concentrate contained doubtful ingredients that may not be considered Halal. Only salt was supplemented to the goats as they are readily available and the cheapest source of mineral for the animals according to all respondents. Moreover, salt served as appetizer and substitute for macro mineral sources such as chloride and sodium necessary for the bones and teeth development.

Water is also important to lubricate bolus or cuds for the goat being a ruminant animal. It aids in the metabolic processes inside animals digestive system, particularly nutrient absorption and transport. It also regulates body temperatures (Giger-Reverdin, et. al., 2011).

On the other hand, 83% of respondents believed that confined goats consumed between 1 to 2 kilogram of forages per day. The rest said goat consumed over two kilograms on a daily basis. On a practical feeding and under field conditions matured goat consumed more than 2 kilograms of roughages a day. JICA and PCAARRD supported this idea that a range goat can consume more than 2 kilograms fresh forages.

Around 72% of the respondents estimated the ADG of their animals and according to them the average daily gain of stall-fed goat is estimated at 70-80 grams per head. Stall fed goat utilizes less energy in grazing and or browsing. Hence, they accumulate more fats than the ranged one (Ghosh and Moitra, 1991).

Aside from being Halal, goats require enough amount of clean drinking water for their normal body functioning and body temperature regulations. All the respondents provided clean drinking water for their goats. Water helps in the digestion process and important component of feeds and body parts.

Farmer-respondents and PCAARRD agreed on the non-supplementation of commercial concentrates to the Halal goat as this may contain animal derivatives not acceptable to the protocol. The two also agreed that about 15-20 heads of goat can accommodate one (1.0) hectare of good pastures. Likewise, PCAARRD and farmers agreed to the point of providing clean drinking water and salt to the goat because accordingly it is needed the animals (Table 6).

Table 6. Comparison of farmers' practices, JICA and PCAARRD protocols on feeds and feeding of Halal goat.

OBSERVATION	JICA PROTOCOL	PCAARRD PROTOCOL	COMPARISON WITH FARMER PRACTICES

Provision of pasture area	Yes	Yes	Same with two protocols
Pasture area	15 heads/hectare In extensive management	15-20 head/hectare in extensive management	Same with JICA and PCAARRD protocols
Common roughages For the goat	Guinea grass, star grass, legumes	Guinea grass, star grass, Ipil-Ipil and Kakawate	Same with the two protocols
Provision of commercial concentrates	Yes but ingredients must be from Halal source	No	Same with PCAARRD protocol
Reason for not providing commercial concentrates	Uncertain of its ingredients source	Possible inclusion of animal-derivatives in the feeds	Same with the two protocols
Provision of salt	Yes	Yes	Same with the two protocols
Reasons	Appetizer and mineral source	Source of macro mineral for bone and teeth development	Same with JICA protocols
Reasons	For convenient purposes	For convenient purposes	Same with the two protocols
Provision of drinking water	Yes	Yes	Same with the two protocols
Reasons for providing drinking water	To lubricate food and nutrient transport	Needed by the animal daily	Same with PCAARRD protocol
Amount of forage consume by goats	More than 2 kilograms when confine	Between 2-4 kilograms when grazing.	Same with the two protocols

Health Management in Goats

Around 94% of respondents believed that quarantine is important before mixing new stock with the existing herd. The reason for quarantining is acclimatize the animal and prevent entry of new diseases to the herd. Routine cleaning and disinfection was done by 79% of the respondents. They removed manures, feed refuse and urine from the premises of the goat house to

prevent possible parasite infection and other communicable diseases. The PCAARRD has been emphasizing this health management.

NAVARRA, et. al., (2020) also found out that the most common physiological disorders in goat are bloating and ORF. According to them, this is commonly observed in a semi-intensive raised goats in the poor pastures.

The respondents also employ deworming as the standard operating procedures (SOP) followed in the livestock and poultry farms to kill intestinal parasites ingested and prevent further multiplication in the digestive system. They used coconut oil in curing bloats and herbs such as madre de cacao and ipil-ipil leaves in deworming their goats.

The use of herbal medicines as first aid in the treatment of bloats and intestinal parasites is recommended by both JICA and PCAARRD because of their anthelmintic properties. They are also economical and practical to use.

For disease prevention, all of the respondents (Table 7) said they did not vaccinate their goats because they are halal. Instead, they used traditional herbal medication as first aid. None of the respondents used commercial or synthetic drugs for their goats because accordingly it is not permitted in Halal production protocol. However, 70 farmers said their goats were bloating and 24, parasite infection. They said that bloated goats were given first aid such as coconut oil mix with the forages to remove excess gases in the rumen. Goats exposed to wet and lush pastures are prone to bloating.

Table 7. Health management practices of respondents on Halal goat.

CRITERIA	FREQUENCY	PERCENTAGE
What sanitary measures you practiced*		
Quarantine the new stocks before mixing in the herd	85	94
Routine disinfection of the goat house and the premises	71	79
Do you practice deworming?		
Yes	90	100
Total	90	100
Common dewormer you used:		
Herbal or medicinal plants	90	100
Do you practice vaccination?		
No	90	100

Are you using commercial antibiotic or drugs for your goats?		
No	90	100
Reason for not using commercial antibiotic or drugs:		
Not required in Halal protocol	90	100
Common diseases you encountered*		
Bloating	70	78
Parasites	24	27
Do you encounter problems in your Halal goat farm?		
Yes	90	100
Source of technical assistance:		
DA Livestock Personnel	90	100
Purpose of raising Halal goat?*		
Source of family income	90	100
Religious offerings	90	100
Personal consumption	53	59

*Multiple Responses

The PCAARRD and farmer-respondents unanimously agreed on the prohibition of synthetic drugs (vaccines) for the deworming of goat. The two also agreed on the application of quarantine measures in the premises of goat house to prevent occurrence of parasitism in the goats (Table 8).

Table 8. Comparison of farmer practices, JICA and PCAARRD protocols on health management practices of Halal goat.

OBSERVATION	JICA PROTOCOL	PCAARRD PROTOCOL	COMPARISON WITH FARMER PRACTICES
Sanitary measures practice	Quarantine and routine disinfection of the house	Quarantine and routine disinfection of the house	Same with the PCAARRD and JIC protocol
Practice of deworming	Yes	Yes	Same with the two protocols
Dewormer use	Medicinal plants	Herbal plants such as Ipil-Ipil and Kakawate	Same with the two protocols
Practice of vaccination	Yes but observe the withdrawal period	No	Same with the PCAARRD protoco
Use of commercial antibiotics	No	Can be used provided it is Halal certified	Same with JICA pr tocol
Reasons for not using commercial antibiotics	Not Halal certified	Not Halal certified	Same with the two protocol
Common diseases encountered	Bloating and parasite infection	Bloating and parasite infection	Same with the two protocol

Economics of Halal Goat Raising

All respondents agreed that they raised goats for religious offerings and as source of family income. Though goat raising is an alternative source of income, most Muslims raise goats as sacrificial animal during religious festivals. This tradition is bequeathed from Prophet Abraham when he tried to slaughter his son Ishmael to testify his belief in the oneness of Allah. PCAARRD emphasized that goat is a beast of burden for Muslims not only in Mindanao but throughout the world. Majority of respondents (94%) said they are utilizing goat's manure as fertilizer for their plantation crops. Animal manure is an excellent source of nitrogen and organic

matter for the growing crops. Manure contained urea needed by the plant for leaf development and greening.

Goat raising is a profitable livestock enterprises and it is considered a major income source for marginal rural populace (Sohaib, M., & Jamil, F. (2017). Aside from providing monetary benefits to household members, goat raising became a leisure to villagers in some areas of Norway according to Bhatti, M., et. al. 2019.

Fifty percent (50%) of the respondents sold their mature goats at the public markets in a liveweight basis thru the intermediaries or agent who transacted directly to the owners. The other 50% negotiated with the agents for the disposal of their ready-to-market goats. None of the goat raisers sold their animals to the auction markets or abattoirs as suggested by PCAARRD (Table 9). Livestock auction markets are seldom found in Maguindanao province because farmer directly sells their animals either to the agents or local markets.

Table 9. Comparison of farmer's practices, JICA and PCAARRD protocols on the utilization of Halal goat and by-products.

OBSERVATION	JICA PROTOCOL	PCAARRD PROTOCOL	COMPARISON WI FARMER'S PRAC TICES
Collection and utilization of manure	Yes	Makrooh (doubtful)	Same with PCAARR protocol
Reasons collection and non collection	Source of organic fertilizer	Makrooh (doubtful)	Same with PCAARR protocol
Marketing channels for goat	Public market and agents	Auction markets, abattoirs and Malls	Same with JICA prot col
Method of selling/pricing	Per head basis	Per kilogram basis	Same with JICA prot col

In the marketing aspects of Halal goat products, farmer-respondents and JICA unanimously agreed that small-holder goat raisers normally sell their live goats thru public markets and agents on per animal basis. On the other hand, PCAARRD and farmer-respondents agreed that goat's waste such as manure and urine are both "Makrooh" or doubtful. Hence, it should not be used as fertilizers for the Halal-compliant crop production.

Problems Encountered in Halal Goat Production

Farmer-respondents revealed that they encountered problems in their goat farms and that they consulted the livestock personnel of the Department of Agriculture-Maguindanao thru the Municipal Agriculture Office. The primary role of the livestock inspectors is to extend technical assistance to livestock farmers within their coverage areas.

Limited livestock inspectors and veterinarian in the province of Maguindanao is one of the major gaps in pursuing goat production particularly in a far plunged areas where accessibility is the major issues such as poor road network, presence of warring groups and water-submerged areas (DAF-ARMM Monitoring Report, 2017)

All of farmer-respondents considered stock selection, housing and fencing, nutrition and health management as an important component of Halal goat raising. If these were compromise, goat enterprise would not be profitable. In terms of breeding and reproduction, 94% percent of the respondents considered it as an important aspect of Halal goat production. While the rest (6%) just considered it as slightly important.

CONCLUSIONS

Results show that the respondents' practices in goat raising at Parang, Maguindanao are not significantly different from the JICA-ARMM goat production and management standards as well as PCAARRD Halal goat production protocol except for the location of the goat house. The study proved that farmers' practice in goat raising has similarities with JICA and PCAARRD protocols except for some aspect such as location of the house, use of commercial and synthetic drugs in vaccination and disease treatments and feeds and feeding. The JICA protocol on housing location is different from the actual practice of farmer respondents and PCAARRD protocol. Farmers are not knowledgeable in the feeding value of combine grass-legume to the goat. Under intensive feeding management, legume-grass combination is a better option in profitable goat raising. In terms of housing, farmers do not practice standard designs such as elevated flooring, floor space requirements and required distances between flooring and ceiling and between the ground and flooring as what PCAARRD and JICA protocol recommended.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

REFERENCES

Ambali, A.R. and Bakar, A.N, 2014. People's awareness on halal foods and products: Potential issues for policy-makers. Procedia- Social and Behavioral Sciences. 121: 3-25. DOI:https://doi.org/10.1016/j.sbspro.2014.01.1104.

Department of Agriculture - Maguindanao, 2017. Planning and Monitoring Report compiled.

GHOSH, T.K. and MOITRA, D.N. 1991. Comparison of body composition and energy utilization of Black Bengal goats under stall-feed and grazing conditions. Small Ruminant Research, 8(3):199-205.

GIGER-REVERDIN S., MORAND-FEHR P., SAUVANT D. 2011. Water intake of dairy goats in intensive systems. In: Ranilla M.J. (ed.), Carro M.D. (ed.), Ben Salem H. (ed.), Morand-Fehr P. (ed.). Challenging strategies to promote the sheep and goat sector in the current global context. Zaragoza: CIHEAM / CSIC / Universidad de León / FAO, p. 233-237 (Options Mediterranean's: Series A. Seminaries Mediterranean's; n. 99).

Navarra, G.A., Salvaña, F.R.P., Sepelagio, E.G., Sanchez, C.B., Besana, C.M., Manceras, L.J.S. Bra, S.G. 2019. Species of forages utilized by farmers producing Halal goats in Bangsamoro Autonomous Region in Muslim Mindanao (BARMM), Philippines. Asian Journal of Ethnobiology. 2(2): 1-7. DOI: 0.13057/asianjethnobiol/y020101

NORTON, B, W. 2006. Recent trends in the application of new technologies to improve goat production in Southeast Asia. Proceedings of The XII AAAP Animal Science Congress, "Challenge of animal industry for the wellbeing of mankind", BEXCO, Busan, Republic of Korea.

PAOLA, J. D., 2012. Business World (Philippines): Guidelines for Halal certification issued.

Philippine Council for Agriculture, Aquatics and Natural Resources Research and Development (PCAARRD 2015). Philippine authentic Halal goat on its way to the market. http://www. pcaarrd.dost.gov.ph/home/portal/index.php/quick- information-dispatch/2570-philippine-authentic-halal- goat-on-its-way-to-the-market

Salvaña, F. R. P., Sepelagio, E. G., Sanchez, C. B., Besana, C. M., Kamamang, J. S., & Cardenas, L. B. (2019). Inventory and diversity of forages utilized by farmers raising goats in Halal way: The case of Region XII, Philippines. Journal of Livestock Science, 10, 118-125.

Sanchez, C. B., Salvaña, F. R. P., Sepelagio, E. G., & Cardenas, L. B. (2020). Challenges in Goat Production Faced by Halal Goat Raisers in Region XII (SOCCSKSARGEN), Philippines. Agricultural Science Digest-A Research Journal, 40(1), 77-83.

Speedy A, Puglièse PL, 1992.Legume trees and other fodder trees as protein sources for livestock. Proceedings of an FAO Expert Consultation held at the Malaysian Agricultural

Research and Development Institute, Kuala Lumpur, Malaysia, 14-18 Oct. 1991. FAO Animal Production and Health Paper No. 102. Rome, FAO. 339 p.

TRAN, H. 2009. PES for the poor in Viet Nam. Information collected from CIFOR, ICRAF and Charles Darwin University. Retrieved from http://www.thiennhien.net/news/193/ ARTICLE/8522/2009-05-06.html

UNESCO (United Nations Educational, Scientific and Cultural Organization). 2004. Empowering youth through national policies.

ZULU, L. C. and RICHARDSON R. B. 2012. Charcoal, livelihoods, and poverty reduction: Evidence from sub-Saharan Africa, Energy for Sustainable Development. http://dx.doi.org/10.1016/j.esd.2012.07.007.