



Study on organic goat production as a tool for sustainability of nomadic pastoralism in north-western Himalayan region, India

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ABSTRACT

Migratory Gaddi sheep and goat constitutes approximately 70% of the total population of small ruminants in Himachal Pradesh, which is in north-western Himalayan region of India. The present investigation was carried out on 32 Gaddi migratory flocks consisting of around 5000 animals (sheep and goat) through structured pre-validated questionnaire to find out scope of nomadic pastoralism for organic goat production. Through cross-sectional surveys, it was found that 100% of breeds reared by the nomads are indigenous in origin, which is well adapted for grazing and browsing in different hilly terrains and topographies. Tethering was not at all practiced among the nomadic flocks of goats. The flocks were herd in corrals during night to prevent predatory loss. The main source of nutrition for goats was rangeland, natural pastures and common property resources. The nomadic goat production system does not substantially compromise the welfare of the animals. Natural suckling and freedom of social behaviour in nomadic flocks are the ethological advantages same as that are required for standards of organic production. Natural breeding is commonly practiced in this nomadic goat production system whereas artificial insemination, embryo transfer and estrus synchronization is unpopular. Ethno-veterinary practices of Gaddi farmers give them an edge over other countries in organic goat production; it can be effective substitute for allopathic medicines but needs to be validated on efficacy and dosage. Exploring and supporting nomadic pastoralism for organic production will help in improving its traceability, meeting consumer satisfaction and sustaining the dwindling nomadic pastoralism.

Keywords: Gaddi goats, India, Migratory goat production, Nomadic pastoralism, Organic production

Himachal Pradesh is a hilly state in the North-western Himalayan region of India (located between 30°22'40" N to 33°12'40" N latitudes and 75°45' 55" E to 79°04' 20" E longitudes). Farmers of the state, especially in arid and semi-arid regions, are dependent on animal husbandry. It has been analyzed that the decrease in CAGR (compound annual growth rate) of goats from 1997-2012 was 6.55 times slower as compared to the sheep and 1.68 times slower as compared to total livestock of the state, which indicates that goat rearing is still a preferable occupation for the people of this state (Dogra *et al.* 2018). Himachal Pradesh has 27% of total geographical area under pasture and grazing land. Total livestock wealth of Himachal Pradesh is 44.11 lakh, of which 25.11% are goats (DADHF 2020). Migratory sheep and goats constitute about 70% of the total sheep and goat population in the state (Misri 1998).

Owing to increasing concern towards the deleterious effects of growth hormones, veterinary drug residues, chemical fertilizers, pesticides in the livestock products;

consumers are willing to pay more for safer and healthier products (Kumar *et al.* 2020). Organic livestock production is considered to be productive and sustainable (Reganold *et al.* 1993, Letourneau and Goldstein 2001, Mader *et al.* 2002). Organic livestock producers commit to respect a list of specifications governing animal care, welfare and feeding, obliging them to give their livestock access to pasture (Leroux *et al.* 2009) which is nutritionally favourable. Indian organic market is experiencing steady growth of around 20% between 2011-2017 (Ernst and Young LLP 2018). India ranked 6th in terms of total land under organic cultivation worldwide and has highest number of organic producers in the world (Willer *et al.* 2022). Nomadic pastoralism which is already organic by default needs to be scientifically validated for its management practice, so that it can be window of opportunity for nascent organic market of India. Therefore, the present investigation was conducted to study the management practices followed by the Gaddi nomads for raising the Gaddi goats on the lines of the standards for organic farming.

MATERIALS AND METHODS

Study area: The study was conducted on en-route nomadic flocks of Gaddi goat in district Kangra of

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Himachal Pradesh during September 2018-April 2020. Study area was purposefully selected as most of the Gaddi flocks have their native place in Kangra district. The flocks were selected from the database of All India Coordinated Research Project on Goat Improvement. (Gaddi Field unit), CSK HP Agricultural University, Palampur. A total of 32 migratory flocks were chosen at random for the present investigations. Thus, the information from 32 migratory flocks was included in the present investigation (Table 1).

Table 1. Details of the respondents selected for present investigation

District	Place	Number of flocks surveyed
Kangra	Palampur	6
Kangra	Kangra	9
Kangra	Thural	3
Hamirpur	Nadaun	2
Bilaspur	Naina Devi	3
Solan	Kasauli	3
Mandi	Barot	2
Kangra	Bir	4
	Total	32

Parameters studied: The desired information was collected through a pre-validated structured questionnaire. Before conducting the study, a written consent was taken from all the respondents using a standardized consent script with the explained aim of the survey and they were informed of confidentiality. The sampling method included interviews with distribution of the questionnaires in person during field interactions. Interview schedule was designed to study the general, reproductive and health management practices of the Gaddi nomads. Mutilations which were prohibited in the organic farming were also covered. The last section covered the marketing of the goats' products by the Gaddi nomads.

Statistical analysis: The completed questionnaires were manually checked before coding into excel data sheets followed by statistical analysis using frequency and percentage.

RESULTS AND DISCUSSION

Socio demographic profile: The proportion of the small, medium and large flocks were 14 (43.75%), 10 (31.25%), and 8 (25%), respectively. The total flock size was 51.13±25.81, 117.08±19.61 and 277.42±39.50 in small, medium and large flocks. The mean age of nomadic pastoralist was 48.05±13.42 years. Most nomads (55%) were 45 years and above. The experience of all the pastoralists in the investigated study was over 20 years (53%). 43.75% of the respondents were illiterate, while 37.5% and 18.75% were having primary and secondary education, respectively. Sukhwinder *et al.* (2020) reported that most of the goat farmers were between 31-60 years old male and illiterate which aligns with the findings of this study. Roy and Tiwari (2016) reported that the mean age of the goat owners around West Bengal and Uttar Pradesh

was around 41 years; mostly illiterate with medium family education status, low social participation but had high experience in goat farming. Patil *et al.* (2012) also reported that most respondents (51%) belonged to the middle age group (37-54 years) and were illiterate. The lower literacy rates among nomadic people and involvement of people with higher age groups reflects the effect of urbanization on youngsters.

Nomadic breeds: The Gaddi breed reared by the nomads has unique adaptive characteristics for the extensive system. 100% of the flocks were rearing breeds of indigenous origin (Table 2). Breeding programmes for organic goat production are mainly focussed on selection for disease or parasite resistance rather than increased milk or meat production. Gaddi goats are very well adapted for grazing and browsing in different hilly terrains and topographies. They are less disease prone hence, require less allopathic medicines. Moreover, the indigenous breeds are more

Table 2. Management practices followed by the Gaddi nomads (N = 32)

Management practice	Response	Frequency (%)
Breeds reared	Indigenous	32 (100%)
	Exotic or cross-bred	-Nil-
Tethering	Not practiced	32 (100%)
Dehorning	Not practiced	32 (100%)
Docking of tail	Not practiced	32 (100%)
Use of feed additives	Not practiced	32 (100%)
GMO's in feed	Not practiced	32 (100%)
Farms using chemicals (Fertilizers, pesticides, etc.)	Not practiced	32 (100%)
Use of feed supplements (Salt, Eruca-sativa, Fenugreek, Chora, etc.)	Practiced	25 (78.1%)
	Not practiced	7 (21.9%)
<i>Kid management practices</i>		
Weaning	Not practiced	32 (100%)
Suckling	Practiced	32 (100%)
Artificial colostrum and Powdered milk	Not practiced	32 (100%)
Weaning age	>6 months	32 (100%)
<i>Reproductive management practices</i>		
Natural mating	Practiced	32 (100%)
Artificial insemination	Not practiced	32 (100%)
Embryo transfer	Not practiced	32 (100%)
Rotation of bucks	Practiced	7 (21.9%)
	Not practiced	25 (78.1%)
<i>Disease management</i>		
Treatment of animals	Allopathic	32 (100%)
	Ethno-veterinary practices	20 (62.50)
Vaccination	Practiced	32 (100%)
Use of hormones	Not practiced	32 (100%)
Dipping	Practiced	32 (100%)
Deworming	Practiced	32 (100%)

resilient to adverse climatic conditions as compared to cross-bred and exotic breeds. Degen (2007) has also reported that the small ruminants raised by the pastoralists are generally low producers but are well adapted to the climatic conditions and resistant to diseases. Their disease resistance inherent behaviour makes them more suitable for organic milk and meat production. Therefore, it can be concluded that nomadic breeds are ideal for organic goat production.

General management practices: The ethological needs of organically farmed animals should be respected in order to allow the expression of their natural behaviour (Braghieri and Napolitni 2009). Animals must be able to express their natural, species-specific behaviour which implies loose housing system and going outdoors or giving them access to an outdoor run or pasturing them. It was observed that the Gaddi goats are neither tethered nor kept in sheds. They are free to move in open grazing areas and are not confined as the goats of stall-fed. They are moved and grazed freely in extensive open areas. Nomadic pastoralist tribes migrate vertically, ascending into higher seasonal pastures during the warmest months and to lower altitudes in the coolest months. Goat flocks migrate from foothills of the Himalayas to high altitude alpine ranges during the summer months and to foothills and plains during the winter season. Similar observations have been reported by CSWRI (2001) and Pandey *et al.* (2002). Furthermore, specifically, during the year, goat flocks start migrating to lower hills during October-November and return to their native villages during April to manure the agricultural fields. Thereafter, the shepherds start migrating to the high-altitude areas for summer grazing.

Feeding management practices: In organic farming, sheep and goats have to be fed with 100% organic feedstuff (EEC Regulation 2007). Organic livestock production is pasture-based feeding, i.e. higher forage-to-concentrate ratio. For organic goat production, the pastures should be organically maintained without the use of pesticides, herbicides and chemical fertilizers. None of the flocks in the present study used the feed additive, GMO's in the feed and chemicals (Fertilizers, pesticides, etc.). All the 32 flocks in this investigation were dependent on natural grassland, common grazing area, meadows etc. (Table 2). Most of the area of Himachal Pradesh has not been swayed by the chemical fertilizers and it is organic, and the farmers are still following the traditional farming practices. THP (Transhuman pastoralism) is seen as an adaptation strategy, because it uses pasture resources at difficult elevations depending on seasonal variability (Agrawal 2010). Gaddi goats get their nutritional requirement through rotational grazing of the pasturelands. In each type of pastureland in different climatic zones, the grazing animals are moved from one plot to another in a time interval (every 10–15 days in the most cases) depending on the herders' estimates of grass cover, and the same plots can be repeatedly grazed during the same grazing season if the coverage and height of grasses have recovered. Pastoralists preferred

tree-cover grazing areas, which include oak trees, as the nutritive value of leaves is rich in iron, sulphur and copper. Feeding of oak leaves having condensed tannins up to 1.6% in diet improved the microbial nitrogen supply, immunoglobulin status and antioxidant status of growing kids (Chaurasiya 2018). This could be attributed to their inherent understanding that tree fodders have similar nutritive value as that of leguminous fodders (Akram *et al.* 1990). Further, only 78.12% of flocks had access to feed supplements (Salt, *Eruca-sativa*, Fenugreek, Chora, etc.). However, none of the pastoralist under study was feeding concentrate to the flocks, which is also reported by Singh *et al.* (2006) in their study.

Reproductive management practices: Animals in an organic production system must be able to reproduce independently, i.e. animals reproduce naturally to express their natural, species-specific behaviour. Natural mating was practiced in all the 32 flocks. However, restricted breeding was practiced so that the doe becomes pregnant only when in the higher hills to take advantage of nutritive quality of the grasses in the higher pasture. Sankhyan *et al.* (2016) also reported 1 kidding per year in Gaddi goats. It was observed that restricted mating was practiced by using breeding apron made of jute or cloth attached to the penis. A few Gaddi's also separated the flocks of sheep and goat, putting the Buck in the sheep flocks and ram in the goat flock. Management solutions to prevent undesirable mating may be more humane than castration (Hosie *et al.* 1996). Reproduction technologies with exception to Artificial Insemination (AI) are not allowed in organic systems. Artificial insemination, embryo transfer and oestrus synchronization are unpopular among Gaddi nomads. Only 21.87% of the flocks were rotating the bucks. Dogra *et al.* (2019) also reported that the farmer owned flock was the primary source (68.4%) of breeding buck among the Gaddi's followed by buck purchased from middleman (20.4%) and only in limited cases (10.2%) the buck was purchased from fellow farmer's flock.

Health management practices: Pastoralists are usually highly knowledgeable about the behaviour and physiology of the animals. 62.5% of those have also mentioned the use of ethno-veterinary medicines especially in higher hills due to poor linkage to the veterinary facilities. Sankhyan *et al.* (2016) also mentioned that the veterinary facilities were usually limited to the low and middle hills. Nomads largely enriched with native technical and health management knowledge, are considered knowledgeable on common replacement of allopathic medicines. This can be an effective substitute for allopathic medicines and will give advantage over other regions or countries in terms of organic production system. Ansari-Renani (2016) had also reported that nomadic pastoralist of southern Iran had their indigenous technical knowledge and medicinal plants for allopathic medicines giving them advantage in organic production system. Use of hormones was discouraged by the nomads in their Gaddi flocks. All the 32 flocks were practicing deworming and dipping. However, there is a

need to use dewormers and dipping agents that are in the national list of organic standards. Council (2007) stated that routine prophylactic medication is not allowed in organic production. However, diseases should be treated immediately to avoid suffering and therapeutic antibiotics are allowed but with longer withdrawal period than the conventional production. Therefore, the nomads need to be educated about the antibiotic's resistance and proper withdrawal period if antibiotics are used for treatment of flocks (Kumar *et al.* 2019, Thakur *et al.* 2019).

Animal welfare: Farm animals under organic regimens are entitled to the right to express their natural behaviour. Goats are a sociable, inquisitive and intelligent species, and their social behaviour may be compromised in the intensive conditions. Organic goat production should provide more welfare for the animals and provide them stress relieving environment. The present study revealed that the nomadic goat production system does not substantially compromise the welfare of the animals as compared to the intensive or conventional production system. Pastoralists ensure improved animal welfare by rearing their stock freely open in extensive grazing areas. Ansari-Renani (2016) had also reported that nomads had well-defined social methods for keeping livestock in groups. The goats also had the opportunity to respond behaviourally, e.g. seeking tree shade to minimize thermal stress. Sharma *et al.* (2003) mentioned that pastoralists are endowed with the special sense of responsibility for the welfare of their livestock.

Mutilations: Mutilation is prohibited in organic goat productions. Procedures that cause pain, such as tail docking, disbudding/dehorning are restricted under organic certification. None of the Gaddi flock under present study was practicing the dehorning and docking in the flock. Mutilations which were performed by the Gaddi flock include the castration and identification of goats by ear cuts. These are performed without using analgesic and NSAID, which might be causing stress in the goats for shorter period of time. Most of the bucks were sold to the traders by the Gaddi's during their migration. Castration is done to cull the bucks which are not desired to be kept for breeding. Castration of the bucks was done by using a knife. Ear tags are also used by a few (12.5%) Gaddi flocks mainly by those adopted by the AICRP Gaddi goat. Hence, measures should be adopted to educate and increase the level of awareness among livestock keepers on welfare-oriented animal management practices especially among nomads for organic goat farming.

Marketing: Generally, there is no organized market for the sale and purchase of goat and goat products in the state and in the country as a whole. Gaddis' are mainly dependent on the market entrepreneurs for the sale of their livestock. All the Gaddi nomads were not satisfied by the market price of the meat animal and cited it as one of the reasons for the decreasing Gaddi flock in the hilly state of Himachal Pradesh. Oberoi and Sharma (1990) had also reported that due to rising constraints being faced by the Gaddi farmers they are depressed, frustrated and carrying

out their profession in a half-hearted manner. Dogra *et al.* (2018) reported that when the Gaddi goat flocks are supplemented with strategic inputs (breeding, feeding and health control), there is an increase in the overall net income and net income per animal per year by 129.42% and 43.24%, respectively. Most of the Gaddi nomads were selling their livestock products generically and there is lack of awareness among the consumers, government and policy makers for the taste and health benefits of such products. The prices of organic products are generally 20-30% higher than those of the conventional products. The organic livestock products fetch premium price due to higher production cost and the tendency for demand to exceed the supply. There is a need to address this awareness issue among masses through training and mass media to make farmers aware of organic standards. Also, development of the niche organic marketing channels in Himachal Pradesh for pastoral products can help in promoting organic goat production.

The agricultural and allied practices in Himachal Pradesh are largely low budget and natural framing based. Moreover, owing to diverse climatic conditions and low population density, the grassland is more organic in nature. All these favourable circumstances provide excellent opportunities to stakeholders to reap the benefits of the organic food production system. Hence, there is an urgent need to explore pastoralism on the lines of organic goat production especially when the population of nomads in the region is decreasing. Organic migratory routes and niche marketing channels need to be developed to strengthen the dwindling nomadic pastoralism. Attitude of consumers and producers need to be studied to enhance the awareness for the nomadic pastoral products. Scope to expand the existing nomadic pastoralism among people should be explored to tap the opportunity for rising consumer awareness for traceability of food products through proper extensive studies, surveillance and certification schemes.

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