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New Look on an Ancient Fiber of Cashmere

Seyed Abbas Rafat

Abstract

The word cashmere in particular refers to the fine fibers of goats that are grown in high and cold regions of the world. There is not a specific cashmere-producing goat in the world, that is, there are many breeds or ecotypes that produce cashmere fibers. Cashmere-producing goats are grown majorly in areas that are very limited in alternative sources of income, such as agriculture or industry. Therefore, raising goats will encourage the villagers to live in the same rural and nomadic areas and do not migrate to cities. Therefore, the socio-ecological aspects of cashmere goat farming are important and must be notified by animal scientists. Structure of hair and cashmere fibers, physiology, and genetic and nongenetic factors that influence cashmere goats has been mentioned. Challenges and problems facing the cashmere industry reviewed briefly in this chapter: In general, cashmere goat production has some very interesting aspects from interaction of animal science and textile industry's viewpoint. Cashmere goats are combined with many other human activities in low-density farming. In the world today, it is necessary to pay more attention to raising goats in less developed areas. We declared the importance of cashmere goats in a whole system of animal production, especially in extensive agriculture systems.

Keywords: cashmere, goats, livelihood, lux textile, agrotourism, fleece, hair, diameter, combing, fine fibers

1. Introduction

The word cashmere in particular refers to the fine fibers of goats that are grown in high and cold regions of the world. Cashmere industry has been noticed again in textile industry in recent years. Fashion designers are passionate about animal fibers including cashmere. So there are high demands for luxury animal fibers. But demand for cashmere sometimes gets sinusoidal. Demand has increased significantly since 2011. If cashmere production's comparative advantage has been considered by producing countries, a good economic result will have been obtained.

There is not a specific cashmere-producing goat in the world, that is, there are many breeds or ecotypes that produce cashmere fibers, so in this chapter our aim from "cashmere goat" is the "cashmere-producing goats." The term of "cashmere goat" refers to goats whose main production is cashmere fibers. Biologically, there are many goats that produce cashmere fibers from their secondary follicles in the skin, but their cashmere quantities are not sufficient as we could nomenclature them as "cashmere goats".

There are some advantages of natural fibers in comparison with synthetic fibers.

Some advantages of natural fibers including animal fibers have the following particular preferences:

- Natural fibers are a healthy choice: Natural fibers provide natural ventilation. Synthetic fibers occasionally cause skin sensitivities, and therefore people with severe skin eczema should be strictly prevented from long contact with synthetic made clothes.
- Natural fibers are a responsible choice: Natural fibers are of major economic importance to many developing countries and vital to the livelihoods and food security of millions of small-scale farmers and processors.
- Natural fibers are a sustainable choice as long as human have access to the sun and soil for agriculture: The emerging “green” economy is based on energy efficiency, renewable feed stocks in polymer products, industrial processes that reduce carbon emissions, and recyclable materials. More recent studies have shown that producing 1 ton of polypropylene—widely used in packaging, containers, and cordage—emits into the atmosphere more than 3 tons of carbon dioxide, the main greenhouse gas responsible for global warming.
- Natural fibers are a high-tech choice: Natural fibers have good mechanical strength, low weight, and low cost. They have some characteristics that make them exclusive in textile industry.
- Natural fibers are a fashionable choice: Natural fibers are at the heart of an eco-fashion or “sustainable clothing” movement that seeks to create garments that are sustainable at every stage of their life cycle, from production to disposal. For example, Cashmere wool is the best sustainable and renewable fiber with virtues to protect the user from the surrounding rudiments [1].

2. Importance of goat production

Perhaps the most important reason of goat keeping is its role in the livelihood of people. This role could not be replaced with other species of ruminants: Raising goats is the only way to save the life of millions of people around the world. Goats can be grown in the areas where it is not possible to breed other animals like cattle or sheep. Furthermore, in some situations, “goat” is the exclusive animal who transforms low-quality roughage to human food. There is some vegetation on steep, mountainous and rocky terrain that can be benefited only by goat production. Because other farm animals such as cattle or sheep cannot live there.

Cashmere-producing goats are grown majorly in areas that there are very limited in alternative sources of income, such as agriculture or industry. Therefore, raising goats will encourage the villagers to live in the same rural and nomadic areas and not migrate to cities.

There is an organ in the body of the goat called the rumen. The rumen can be named as a high-performance “bioreactor” because its output is higher than input! We consider rumen as a very large “Petri dish” that transforms efficiently nonprotein nitrogen to valuable animal protein consumable by human.

Estimation of goat population from FAO STAT is presented in **Figure 1**. Major cashmere-producing countries are China, Mongolia, Iran, Afghanistan, Kazakhstan, Kyrgyzstan, Pakistan, Turkey, and other minor producers such as New Zealand. China is the world’s largest producer of cashmere production, accounting for more than 70% of world output; Mongolian cashmere production accounts for about 20% [2]. Other estimates showed that China and Mongolia produce 60–70%

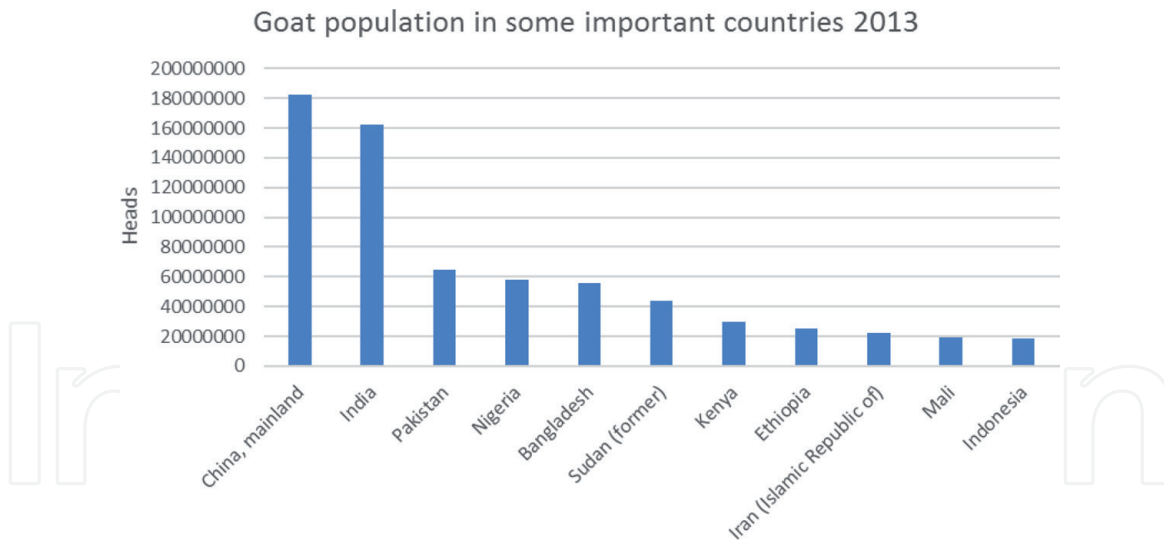


Figure 1.
 Estimation of goat population. FAO stat 2019.

| Source of cashmere | Price in 2000 (US\$/kg) | Price in 2018 | 2005 # | 2010 # | 2015 # | 2016 # | 2017 # | 2018 # | 2019 # |
|------------------------|-------------------------|------------------------|--------------------|--------|--------|--------|--------|--------|--------|
| China | * | 600–800 UMB/KG | 94 | 127 | 124 | 109 | 110 | 140 | 131 |
| Mongolia (14–15.5 μm) | 105 | 105.000–110.000 MNT/kg | 74 | 98 | 88 | 82 | 78 | 118 | 95 |
| Iran (17.5–18 μm) | 75 | * | 58 | 87 | 86 | 73 | 69 | 97 | 108 |
| Kazakhstan (19–19.5 μ) | 17–50 | * | * | * | * | * | * | * | * |
| Reference | D. B. Holdsworth | | www.gschneider.com | | | | | | |

*Not available data.
 #Schneider index.

Table 1.
 Price estimation of exported dehaired-cashmere in some countries.

of the world production of raw cashmere while and Iran and Afghanistan produce nearly y the rest (20–30%) [3].

Also there are some other estimations about cashmere production quantity. It is estimated that production of raw cashmere be nearly 8000 tons annually [4]. Australia and New Zealand between them produced just 45 tons of down [4]. **Table 1** shows an estimation of exported dehaired cashmere in some countries. Iran is one of the main producers and exporters of cashmere in the world, third after China and Mongolia. Of the 25 million goats in Iran, 5 million are cashmere-producing goats.

We have no access to any exact statistics about the cashmere production in the world. We can summarize the following reasons for this:

- The exact figures of cashmere amount are not available in the major cashmere-producing countries.
- This product is constantly traded between the producer countries. It's difficult to find the source of existing cashmere at trading time. For example, cashmere of Afghanistan is traded among Iran, Tajikistan, Kyrgyzstan and China:

- Cashmere is considered more likely as a by-product, so governments do not pay enough attention to collect exact data.
- The production of cashmere cannot be estimated from the number of goats. There is no direct relation between the number of animal or animal weight and the production of cashmere. For the reason of existing very different cashmere-producing breeds/ecotypes with diverse genetic potential of cashmere production, it is difficult to estimate total cashmere production from the data of animal numbers.

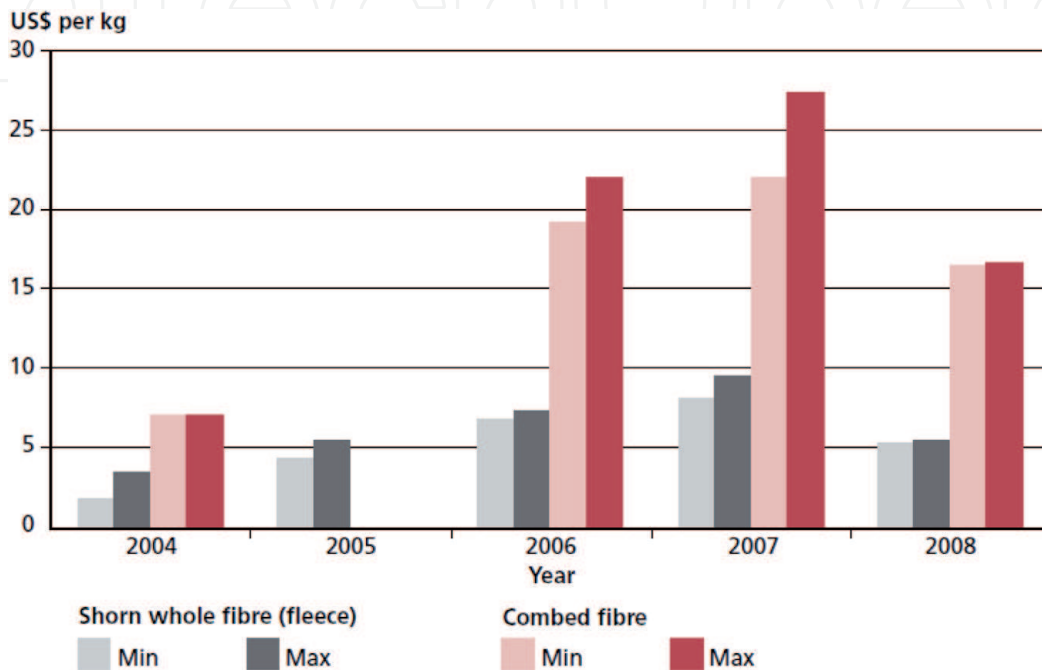


Figure 2. Raw cashmere purchase price from farmers (LPP, LIFE Network, IUCN-WISP and FAO, 2010. Adding value to livestock diversity – Marketing to promote local breeds and improve livelihoods. FAO Animal Production and Health Paper. No. 168. Rome).

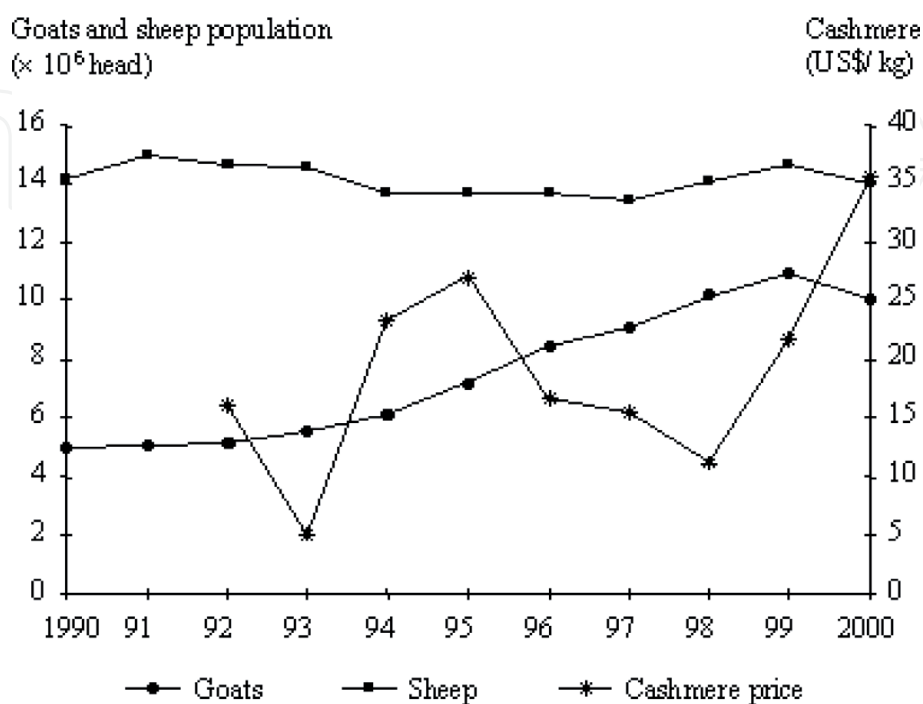


Figure 3. Goats and sheep population and cashmere prices in Mongolia, 1992–2000, Sources: Bakey et al. (2001); FAO (2002).

- Demand and consumption diagram of cashmere has sinus form. Therefore, the cashmere warehouse has effect on exports and imports of cashmere. Sometimes cashmere has been deposit until rising of prices.
- The major areas of cashmere production are mountainous, in extensive system of animal production. So estimation or recording of cashmere production is not possible precisely. Exceptionally New Zealand and Australia publish their exact statistics about their low quantity of cashmere production.
- Due to the competition of textile companies among them, accurate information is not provided on the supply of raw materials. Cashmere harvest system in China (combing) is different in comparison with Iran and Afghanistan (Shearing), so it is difficult to compare quantity of cashmere production from fleece weight.

We mention here for example, two figures of estimation of raw cashmere purchase price from farmers (**Figure 2**) and cashmere prices in Mongolia, 1992–2000 (**Figure 3**).

3. Biology

3.1 Most important cashmere-producing breeds

From a biological viewpoint, all of the dairy goats produce cashmere, but in some breed the production of cashmere is noticeable, so they have been nomenclatured as “cashmere-producing goats.” Indeed, many breeds of goat have secondary follicles in their skin that produce “down coat” or cashmere. But the amount of this cashmere is very different among breeds. So, from each goat, we can harvest cashmere, but its quantity may be 10–500 gr/animals. In conclusion, the breeds with sufficient quantity of down fibers will be famous as cashmere goats. For example, some breeds are shown in **Figures 4–6**. In the literature, various words could be found for cashmere, e.g., Kork, Tuvet, and pashmina. Cashmere goat is named as Tibet goat in some bibliographies. Some cashmere-producing goats are Nningza, Soyana, Gansu, and Raeini. The wild goat of *Capra hircus blythi* found in Sind and Baluchistan is probably a descendant of cashmere goats.



Figure 4. Main cashmere goat breeds of Iran: Raeini (first row), Nadoushan (second row) and Birjandi (third row). (Ansari 2013).



Figure 5.
Cashmere goats in Herat, Afghanistan (photo by A. B. Hotak, cashmere world, 2014).



Figure 6.
A cashmere goat farm, Kirghizstan. S. A. Rafat 2012.

3.2 Terminology

For the readers it may be interesting to be familiarized a little about terminology of some animal fibers. General fiber's name, species, and scientific name of some important animals in the world of "animal fibers" are:

- Wool: From sheep (*Ovis aries*)
- Cashmere: From cashmere goats: *Capra hircus* Laniger

- Mohair: From Angora goats: *Capra hircus aegagrus*
- Cashgora: a crossbreed of cashmere and Angora (Mohair) goats
- Angora: From Angora rabbits: (*Oryctolagus cuniculus*)

3.3 Cashmere products

Cashmere is a delicate fiber of certain goats that are bred in high and cold regions of the world. The term of cashmere was named as it taken from countries of China, Iran, and Afghanistan to the Kashmir region. In Kashmir, these fibers has been transformed into precious shawls.

In the past few years, the cashmere industry has attracted the attention of the textile industry, which is referred to as “the renaissance of cashmere.” The reasons for this reminiscent of cashmere are the interest of individuals and designers of natural fibers; global markets including China; the contribution to sustainable development and the global fight against poverty. According to some researchers, Central Asian countries are potential future suppliers of cashmere.

Cashmere is used in luxury textiles of niche markets, including shawls, coats, cushions, blankets, runners, sweaters, t-shirts, scarves, shawls, and so on (see **Figures 7–9**). A wide range of high-quality and expensive products are produced from cashmere. Cashmere’s clothing is generally light and at the same time keeps the human body warm. Designers of clothing use this fiber as a good material that has a lot of design and color.

3.4 Structure of hair and cashmere fibers

The staple of cashmere goat is made up of two parts of the outer coat (hair) and inner coat (cashmere). The hair is thicker and longer and has a medulla channel in the center of the fiber, protecting the animal against physical damages, while cashmere protects the animal from the cold. The cashmere fibers are similar to true wool, which is like a cylinder full of keratin. Three types of medulla have been recognized in hair: Continuous, no breaks in the medulla; interrupted, few short breaks; and fragmented, few parts of medulla visible. Characteristics of these three types of hair in mixed final products of hair should be studied. For more information see *Silk, Mohair, Cashmere and Other Luxury Fibers* edited by Franck [5].

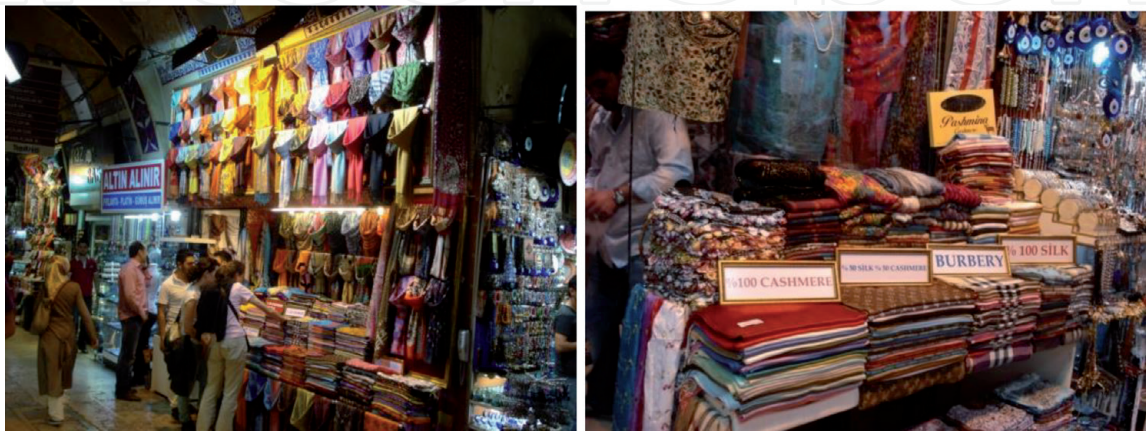


Figure 7.
Istanbul Cashmere Bazaar – Price of each Shwal is nearly 300–500 US \$ - 2014 - Photo by seyed abbas rafat.



Figure 8. Jewelry Stores in Istanbul beside cashmere product stores. “Cashmere = Gold”. The nick name of cashmere in this Bazaar is “white gold” – 2014 – Photo by Seyed Abbas rafat.



Figure 9. Left: SUSTAINABLE CASHMERE® HANDKNITTED SHAWL-: www.chianticashmere.com. Right: Cashmere fibers utilized for a traditional hat, Azerbaijan, Iran photo by: Abbas hüseyinlu.

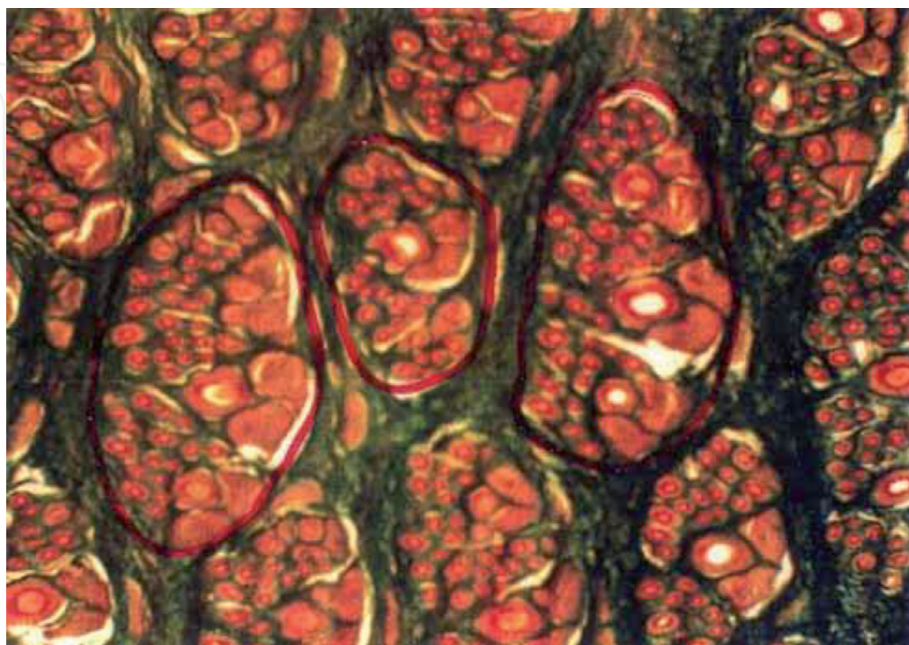


Figure 10. “Trio” Follicle Groups of Cashmere Goat Skin, Raeini cashmere goat, Kerman, Iran. Rafat M Sc. Thesis.



Figure 11.
Follicle group in cashmere goat in cross section view. P = primary follicle. S = secondary follicle RAFAT M Sc. Thesis.

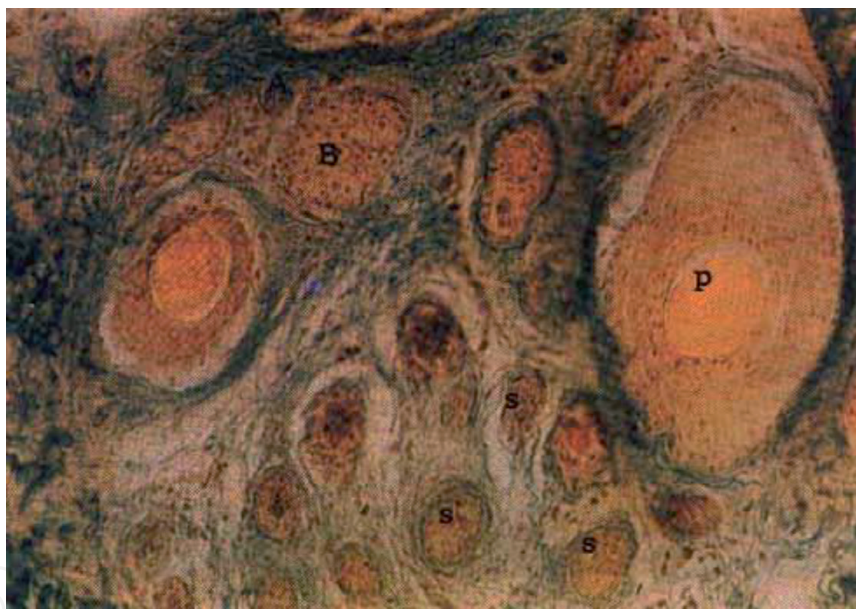


Figure 12.
Inactive Secondary Follicles (s), Primary follicle (p) and sebaceous gland (B). Rafat M Sc. Thesis.

The growth of hair in the staple of cashmere goats occurs seasonally. That means cashmere, in general, takes 6 months to grow (anagen) and then enter the growth stop (telogen) with a middle stage of catagen. The shedding of cashmere from the body depends on some factors, such as the length of the day of photoperiod, nutrition, and the physiological state of the animal, and cashmere begins to grow from late spring, and in the winter it stops growing, and with the arrival of spring, cashmere is separated from the body until the next growth period begins. The large variation of shedding time exists among and between breeds.

Hair follicle or “small factory of keratin production” has an organized structure with the name of “trio group.” Each group has normally between 1 and 3 first follicle and some secondary follicle (5–50). Primary follicles, sweat glands, sebaceous glands, and arrector pili muscle are other small organs within a trio group (**Figures 10–12**). By verifying the structure of skin in histological studies, we can distinguish some

traits of follicles, e.g., secondary to primary ratio, percentage of inactive secondary follicles, diameter of follicles and density of follicles per surface of skin.

4. Genetic and nongenetic effects

4.1 Nongenetic factors

Fiber producing animals majorly divided into two categories:

- 1 One-coat (e.g., Angora goats, Merinos sheep)
- 2 Two-coat: (a) Outer coat for summer, physical protection, and (b) inner coat for winter thermal insulation, e.g., cashmere goats, Angora rabbits, camel, wild sheep.

The most important characteristics of cashmere are means of fiber diameter, length, and color. Definition of cashmere quality depends on yield, diameter, length, and color. Microscopic measurements of fiber characteristics are projection microscope and OFDA. The first method, although it is a basic method, is very time-consuming and can have an operator bias. The second method of OFDA is a very fast method that measures about 2000 fibers in a few minutes. Mean fiber diameter, standard deviation, and percentage of hair could be measured rapidly with OFDA.

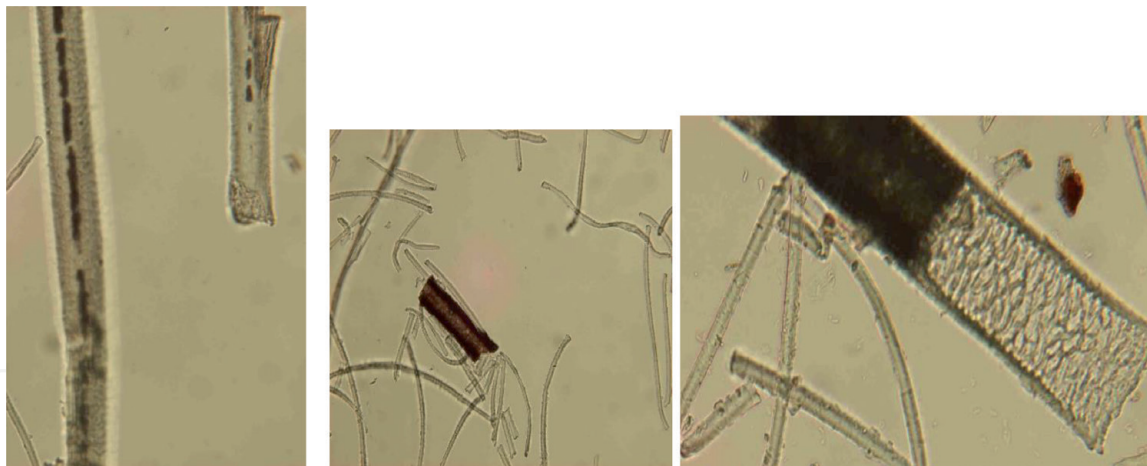


Figure 13. Cashmere and hair fibers under light microscopy – University of Tabriz.

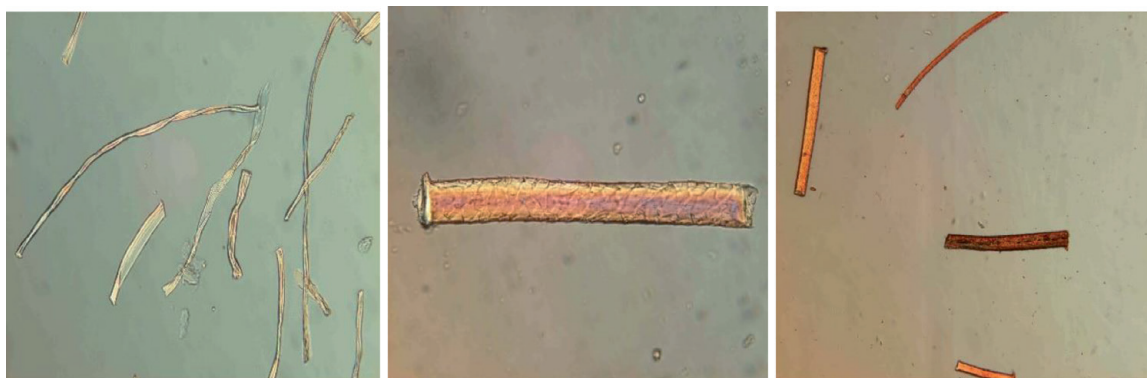


Figure 14. Cotton (left), true wool (middle) and colored (right) carpet wool fibers. University of Tabriz.



Figure 15.
Cashmere, light and dark gray, 100x. University of Tabriz.

Microscopic study of cashmere shows us the specific structures of fine fibers and modulation forms. Furthermore we can distinguish different types of fibers that may be mixed within cashmere tops of fabrics (**Figures 13–15**).

Characteristics of Iranian cashmere as an example of cashmere goat are measured as [6]:

- Raw fleece weight: 540 gr (100–700 gr)
- Yield: $56.5 \pm 12.2\%$
- Mean fiber diameter $19.7 \pm 1.5 \mu\text{m}$, range of 17–21
- Fiber diameter standard deviation of $4.5 \pm 0.6 \mu\text{m}$,
- Fiber curvature of $62.9 \pm 8.5^\circ/\text{mm}$
- Staple length of $54.2 \pm 7.0 \text{ mm}$

The diameter, length, color, and amount of impurities are the factors that affect cashmere price. High mean fiber diameter, colored fibers, short length of fiber, hair, and high percentage of impurities are factors which influence the prices of Iranian cashmere. Large changes in price of raw cashmere, low technology of cashmere end-products in the country, and lack of home market for cashmere products are the problems that face the cashmere goat breeding. A solution is upgrading the technologies related to cashmere processing, and this must be accompanied with collaboration of farmers. Also it must conserve genetic resources of cashmere goats and utilize animal breeding techniques for decreasing mean fiber diameter. Environment situation has some effects on cashmere growth. These effects are including nutrition and different proteins, energy to protein ratio, body condition score, body size, vitamins, minerals and hormones, The effect of fetal feeding on follicle formation during pregnancy period. Non genetic effects on cashmere could be age, flock, harvest technique, color, year, season, shedding, parasites, location of body, physiological state of pregnancy and lactation. For example, effect of sex, age, and flocks on cashmere diameter and staple length of Raieni goats has been studied by Shamsaddini et al. [7]. Interaction of sex and age has significantly effect on cashmere characteristics ($P < 0.05$) staple length between station and nomadic goats.

The age groups had a significant effect ($P < 0.05$) on coefficient of the variation of cashmere's fiber diameter. It was concluded that the first 15 days after birth is much more important to develop secondary follicles in Raeini cashmere kids and affects cashmere production of Raeini kids in the economic life span [8]. It was evident that cashmere mean fiber diameter and coefficient of variation of cashmere's fiber diameter were effected ($P < 0.05$) by different seasons. An outstanding researcher on the effects of nutrition on cashmere goats is B. McGregor. Readers are advised to see his article of [9].

4.2 Genetics

Generally, cashmere fibers are genetically similar to those of sheep wool, same as the rules governing quantitative genetic of cashmere. For example, the main trait of fiber production, i.e., wool yield and fiber diameter, is considered as a quantitative trait. But color trait of cashmere, similar to color of wool in the classic genetic, has been considered as a categorical trait, so its distribution is different from normal. There are many researches on cashmere production that showed nearly all important traits of cashmere are genetically heritable. Therefore with selection of the best reproduction candidate among goats, we can arrive to the improvement in cashmere traits. Heritability of cashmere production traits is similar to sheep wool, so the principals of quantitative genetics could be utilized in cashmere goats. However, some differences should be notified in cashmere in comparison with wool. Fleece of cashmere goat is a double coat, so it is very different from fleece of Merinos sheep. Merino sheep has one-coat fleece, but cashmere goat has a specific type of fleece in which two different fibers exist. Scale pattern of cashmere and fine wool is different, and that is a major reference distinguishing them from each other.

4.3 Selection aim

Cashmere is an ornamental product, special and luxurious, and the supply and demand in the international marketplace have influenced the domestic purchase prices of raw cashmere, and consequently the income of livestock farmers is affected by raw crude sales. The price of raw cashmere (fleece: majorly including hair and cashmere) purchase from the herd has been fluctuating every year, and as a result, their livelihood affects the breeding of cashmere goats. The consequence of this process is a challenge for genetic improvement of goats. Farmer changes his livestock composition when the price of cashmere decreasing. So he select his animals toward other traits of meat or milk prefer than cashmere.

Therefore, it is necessary to support the cashmere farmers stabilization of purchasing prices. Because farmer does not have the financial capability to pursue breeding programs and maintain breed purity in favorite of cashmere. A solutions for problems of the cashmere goat breeding is provision of scientific-technical supports and the formation of NGOs and breed associations. It must stabilize the purchase price of raw cashmere and minimize the negative effect of fluctuations in global prices on local goat production. It needs to establish cooperative factories to access more value-added products and identify domestic and foreign consumption markets. To achieve this, not only the livestock sector but also other sectors, such as textile, apparel and design, and art, should also work together in producer countries. Genetic markers has been found that help the animal breeders to use in selection of the more profitable cashmere goats. Furthermore, genome wide association studies has been started in goats which is an effective method for genetic improvement of cashmere goats.

The both method of classic best linear unbiased prediction (BLUP) and new genomic BLUP could be utilized in genetic improvement of cashmere goats. The important step of application of new methods of genomic selection is to measure



Figure 16. Liaoning cashmere goats (left) and other breeds (right) from China (with thanks for photo provided by M. Yasen Xinjiang Animal Science Academy Tian Kechuan).

phenotypic traits as much as possible. There is need to record phenotype traits in cashmere goats in new area of genomic selection. The genetic improvement of cashmere goat is necessary through classic genetic and modern genomic approaches.

Genetic improvement of fiber-producing animals is accelerated by new genomic provided data. In the near future, beside classic genetics, molecular genetics-based sciences such as transcriptome, SNP chip, and “marker-assisted selection” will be applied in cashmere goat’s genetic breeding programs. Crossbreeding of cashmere goats with Angora goats produces a specific type of fibers with the name of “Cashghora.” For example, this type of crossbreeding is currently used in Asia, for example in Kirghizstan.

China has suitable experiences in genetic improvement of cashmere goats (Figure 16).

4.4 Cashmere harvest

Basically, there are two methods of removing fibers from the goat’s body: manual scissors and combing method. For combing method please see video MOV08863.



Figure 17. Harvesting of cashmere with combing method (Kirghizstan, photo by Rafat).

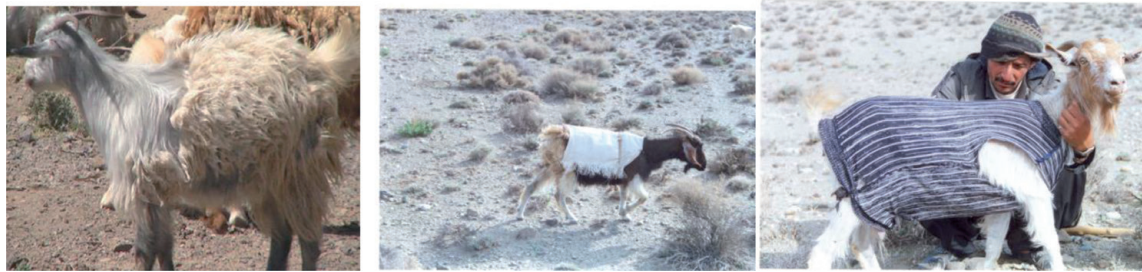


Figure 18.

Cashmere goat of Iran: Raeini breed. Left: Shedding of cashmere in spring. Middle and right: Cashmere goat covered by fabrics to protect animal from cold weather after natural shedding of cashmere in early winter, Baft, Kerman, Iran. Rafat M.Sc. Thesis.



Figure 19.

Cover for cashmere goat to protect them after shearing in cold weather of Tabriz, Tabriz, University of Tabriz, Khalat pooshan research center.

Scissors are used in Afghanistan, Iran, Kyrgyzstan, Tajikistan, and similar countries. The resulting harvested fleece is a mixture of cashmere and hair. Combing methods (**Figure 17**) produces more pure cashmere content among harvested fibers from animal in comparison with shearing. So the harvested fibers are mostly cashmere with less hair fibers content. Farmers that use scissors to harvest fibers, they does not paying attention to quality when buying and selling. The only trait of interest is weight of fibers. But in countries that farmers use combing method, qualitative criteria are considered when selling. Cashmere goats are very sensitive to cold weather after shearing of cashmere. So decision on the suitable time for cashmere shearing is important. Sometimes we see some animals that shed their fibers very early, so goat keepers have some technics to protect their animals from cold weather (**Figures 17–19**).

5. Agrotourism and challenges of cashmere production

Breeding goats can help develop agrotourism. Many tourists like to buy real cashmere from their main production site. This can lead to the employment of the villagers and prevent migration from rural to urban areas. It is also good for governments to strengthen cashmere's industry to solve the unemployment problem. Investing in the goat production industry and cashmere production results in profitability

compared with other industries. Because cashmere production is consistent with sustainable agriculture, it has less environmental problems and is not polluting.

The tourism industry and agrotourism and ecotourism can also be considered in contributing to the developing of cashmere industry. In producer countries, the traditional textile industry structure should be developed with the participation of livestock producers, so that livestock farmers are directly benefited from the cost of buying and selling of final products. Research and educational centers can support livestock production in this field or provide technical and scientific information. In the province of Kurdistan of Iran, the goat breed of “Morkhoz” is a practical example of agrotourism with presentation of local cloths from goat fibers. Morkhoz goat produces a special type of fiber that is utilized in a type traditional handmade clothing. So, all process steps from goat keeping until final cloth preparation has been made within the region. For more information see Rafat 2001. In other countries, examples of this type can also be cited. Nora Kravis (Chianti Cashmere), a veterinarian in Italy who created a flock of goats in 1970s, has become one of the most successful cashmere-producing farms, selling products of cashmere, and is now emerging as an example of successful rural entrepreneurship. In some countries of cashmere production, such as Afghanistan, they established in 2007 the first ever scouring line, Herati Cashmere. In some cashmere production regions, the model of Mohair production in France may be examined.

However, despite these attractive conditions, goat keepers are increasingly abandoning their activity for higher-income jobs. The young generation is not interested in cashmere goat production. The cashmere-producing countries need to find solutions to make the profession more appealing to young people. One way would be to increase their income significantly. The other challenges of cashmere productions are:

- More attractive jobs in comparison with goat keeping
- Low price of cashmere from producer (e.g., 15–20 USD, spring 2012, Iran)
- Purchase fleeces without any attention to fitness, yield, staple length, color, and other quality criteria
- Ecological concerns about goat production
- Multivariate selection for genetic improvement of goats
- Introduction of genomic selection in goats
- How to learn the community, producers, utilizers, and students about the importance of animal fibers and cashmere
- Organization for workshop, seminars, video conference, email group, etc. for learning more

For increasing returns and to improve qualitative and quantitative characters of cashmere, cashmere producers and commercial trading partners need to complete the processing cycle.

Another challenge is how aware the goat keepers with principal methods of animal breeding are. It needs to learn to the farmer new techniques of animal selection. They must to consider color or fleece weight in selecting of reproductive animals. Furthermore, how we can select among reproductive animals for several

traits together, e.g., selection for birth weight, fertility, mature weight, resistance to diseases beside fiber traits.

Ansari-Renani et al. [10] studied improving livelihoods of small farmers and rural women through value-added processing and export of cashmere. Small producers of cashmere goats in Tajikistan, Kyrgyzstan, and Iran share the problem of poor access to world fiber markets and as a result experience considerable losses of income. Many of the program activities targeting production and market constraints of the cashmere can be implicated based on following development program: Analysis of markets and farmers' access to market; improvement in goat management within households; improvement in shearing and classification of fiber; and standardization based on international quality standards.

6. Material and methods

The materials and methods used in this chapter of the book were (a) to do a bibliography including author's researches [11–16] on cashmere goats. In some of the author's researches, he measured fiber characteristics by himself with microprojection technic. For example, in one of them, we tried to know the effects of age and feeding level on fiber diameter of cashmere [12].

So in this bibliography, the author's experiences were the majority part of the chapter. These experiences included:

- Frequent visits to goat breeding areas and living with goat keepers.
- Contact with cashmere goat keepers. Their livelihood depends on cashmere production.
- Research on characteristics of cashmere and genetics of cashmere goats.
- The results of some of these activities helped to clarify the origin of goats in the world [11].

7. Conclusions

In this chapter, we tried to see the cashmere fiber from another perspective. This view was based on the dependence of the life of farmers on the production of cashmere. Economic significance, the principles of biology, the structure of cashmere goats, genetics, and fiber-based products were reviewed. The importance of raising goats for the production of cashmere is further noticed by the fact that in the modern life of today's world, there are those people whose livelihoods depend on the sale of cashmere. It is necessary to introduce cashmere to the new generation of students in the field of animal science. A lot of interesting research and achievements about cashmere happened 50 years ago. The task of the authors of livestock books is to familiarize young researchers with this subject. This chapter was an attempt to familiarize readers with the main concepts of cashmere industry. There are issues in the textile industry that are related to raw materials. Solving the problem of raw materials is the responsibility of the animal breeders. The needs of the consumer and the cloth's fashion world should be identified. Then livestock scientists, including animal nutritionist, physiologists, and geneticist, try to produce the raw material of cashmere needed by the industry. At the same time, it will supply income for goat keepers. Cashmere production helps our world to live more peaceful.

Conflict of interest

We have not any “conflict of interest.”

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Author details

Seyed Abbas Rafat
Department of Animal Science, Faculty of Agriculture, University of Tabriz,
Tabriz, Iran

*Address all correspondence to: rafata@tabrizu.ac.ir

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