Goat Meat Production in Asia

Proceedings of a workshop held in Tando Jam, Pakistan, 13–18 March 1988
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Abstract: This publication presents the results of a workshop held in Tando Jam, Pakistan, 13-18 March 1988, that focused specifically on all aspects of goat meat production in Asia. The workshop addressed the factors affecting meat production (breeding, nutrition, reproduction, sex, management, animal health, and diseases), the nutritional value of goat meat, methods of slaughter, processing techniques, consumer preferences, and the national and international marketing of goats. The detailed discussions on these aspects were further highlighted by country case studies, prevailing situations, issues and policies, and potential for improving the prevailing patterns of production. An important session covered broader issues concerned with research and development, strategies for increasing production, and export potential, especially in Near East markets. These discussions enabled a definition of research and development priorities and the scope for increasing goat meat production.

Résumé: Cette publication fait le compte rendu d'un atelier tenu à Tando Jam, au Pakistan, du 13 au 18 mars 1988 et qui a porté sur tous les aspects de la production de la viande de chèvre en Asie. Il y a été question notamment des facteurs influant sur la production de la viande (sélection des espèces, nutrition, reproduction, sexe, gestion, santé animale et maladies), de la valeur nutritive de la viande de chèvre, des méthodes d'abattage, des techniques de transformation, des préférences des consommateurs et du marketing national et international des chèvres. En plus de discuter de ces questions en profondeur, les participants ont aussi abordé les points suivants : études de cas de certains pays, situations actuelles, enjeux et politiques, et possibilités d'améliorer les tendances actuelles de la production. Lors d'une séance importante, les participants se sont penchés sur des questions plus vastes concernant la recherche et le développement, les stratégies qui permettraient d'augmenter la production et les possibilités d'exportation, particulièrement vers les marchés du Proche-Orient. Ces discussions ont permis de définir des priorités en matière de recherche et de développement et de déterminer le potentiel de croissance de la production de la viande de chèvre.

Resumen: Esta publicación contiene los resultados de un taller celebrado en Tando Jam, Paquistán, del 13 al 18 de marzo de 1988, dedicado específicamente a todos los aspectos de la producción de carne de cabra en Asia. El taller estudió los factores que afectan la producción de carne de cabra (cruce, nutrición, reproducción, sexo, manejo, salud y enfermedades), el valor nutricional de la carne caprina, los métodos de sacrificio, las técnicas de procesamiento, las preferencias del consumidor y el mercado caprino nacional e internacional. Las discusiones detalladas sobre estos aspectos se vieron además enriquecidas con el potencial para mejorar los patrones prevalecientes de producción. Una de las sesiones importantes cubrió los aspectos más amplios de investigación y desarrollo, estrategias para el aumento de la producción, potencial de exportación, especialmente en los mercados del cercano oriente. Las discusiones permitieron determinar las prioridades de investigación y desarrollo así como las posibilidades para aumentar la producción de carne caprina.
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By-products from goat meat production and their marketing in India

K. Seshagiri Rao
Central Leather Research Institute,
Madras 600 020, India

Abstract: India, with 95 million goats (1982), annually produces 69 million goat skins and an equal amount of intestines through slaughter. Through a wide network of marketing systems, the goat skins are mobilized and converted into different end products. The value addition in processing reaches 350% and provides substantial employment. The Government of India has provided the necessary policy backup for stimulating processing activity and for promoting exports of goat skins as leathers and leather products. The goat skin based leathers and leather products claim 45% of the country's leather exports. The bulk of intestines is used in edible products (e.g., sausage casings) because of the high price of meat; the balance is used for cat guts and, to a small extent, sports guts. Sausage casings and cat guts are exported. Blood is another item used in edible products. The future seems bright for the enhanced production of by-products and their industrial exploitation for which necessary development programs and policies are now being contemplated by the Government of India.

Résumé: En Inde, dont le cheptel caprin est de 95 millions de têtes (1982), les abattoirs produisent chaque année 69 millions de peaux de chèvre et une quantité égale d'intestins. Le vaste réseau de systèmes de commercialisation permet la transformation de ces peaux de chèvre en différents produits. L'augmentation de leur valeur atteint les 350 % et représente une source d'emploi substantielle. Le gouvernement de l'Inde a fourni l'appui politique nécessaire pour stimuler l'industrie de la transformation et promouvoir les exportations de peaux de chèvre (cuir et de produits en cuir) lesquelles représentent 45 % des exportations de cuir du pays. Quant aux intestins, ils sont employés dans les produits comestibles (p. ex., comme boyaux pour la saucisse) en raison du prix élevé de la viande; le reste est utilisé dans la fabrication de cordes de boyau et, dans une faible mesure, de cordes de raquettes. Les boyaux pour la saucisse et les cordes de boyau sont deux produits d'exportation. Le sang est lui aussi utilisé dans la fabrication de produits comestibles. L'avenir semble brillant pour la fabrication accrue de sous-produits tirés de la chèvre. Le gouvernement de l'Inde envisage actuellement l'adoption de programmes et de politiques en vue de leur exploitation industrielle.

Resumen: India, con 95 millones de cabras (1982) produce anualmente 69 millones de pieles de cabras y una cantidad igual de intestinos producto del sacrificio. A través de una amplia red de sistemas de comercialización, las pieles de cabra se convierten en diferentes productos finales. El valor adicional en el procesamiento alcanza el 350% y provee empleos substanciales. El gobierno de la India ha proporcionado el apoyo necesario a la política para estimular la actividad de procesamiento y para promover las exportaciones de pieles de cabra como pieles y productos de cuero. Las pieles y productos de cuero que se fabrican a partir de la piel de cabra constituyen el 45% de las exportaciones de piel del país. El grueso de los intestinos se utiliza en productos comestibles (por ejemplo tripas para salchichas) debido al alto precio de la carne; el resto del producto se utiliza para la fabricación de cuerdas en general y, en menor escala, tripas de pelo para equipos deportivos. Las tripas de salchichas y las cuerdas se exportan. La sangre es otro elemento que se utiliza en productos comestibles. El futuro parece prometedor para un aumento en la producción de subproductos y su explotación industrial, para lo cual el gobierno indio está contemplando actualmente políticas y programas necesarios para su explotación industrial.

With 95 million goats, accounting for 20% of the world stock, India has the largest goat population in the world (1982). According to Gopalakrishnan (1981),

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goats in India contributed $0.25 \times 10^6$ t meat, $0.7 \times 10^6$ t milk, more than $60 \times 10^6$ pieces of skin, 300 t hair, and an enormous quantity of dung in 1981. Between 1961 and 1982, the goat population showed an annual growth rate of 2.7% in contrast to 0.9% for sheep, 0.5% for cattle, and 1.7% for buffalo (Seshagiri Rao 1987). Its higher reproductive rate and its adaptability to different types of feed and management give goats an advantage over other livestock species in terms of economic importance at the farm level. If the same trend of growth continues, the goat population will reach 145 million by the year 2002 and its share of the combined goat and sheep stock would rise from 66.5% in 1982 to 72.3% in 2002 (Seshagiri Rao 1987). In terms of availability of animals per 1000 humans, goat is the only species that has shown a positive growth (131 to 136) between 1951 and 1982; the availability of other species has dropped significantly: sheep, 108 to 69; cattle, 430 to 278; buffalo, 120 to 100. Clearly, the goat population is continuing to grow and will maintain its position as a major source of meat in India for years to come.

In recent years, on account of drought in several parts of India as well as a dwindling meat animal supply, the price of goat meat has increased considerably. Between 1977 and 1987, goat meat prices increased fourfold; cereals and pulses during the same period increased twofold in the Madras market. Both the average meat yield and the average skin area from goat slaughter have declined (CLRI 1987). This indicates that underage animals are being slaughtered prematurely in large numbers because of the inelastic supply of animals and the high demand for meat. To avert this situation, policies should be introduced to curb the slaughter of underage, productive, and seed stock; simultaneously, the meat animal stock should also be improved through systematic goat-farming programs. The 10.9% mortality among goats because of disease could be reduced through better medical care. The size of the stock, their growth trends, and the magnitude of slaughter are some factors that have a significant effect on the production of meat as well as the various by-products such as skins, blood, and intestines.

**Realization from goat slaughter**

Skins, intestines, and blood are the three major by-products, accounting for 14.4% of the total value realized from the slaughter of a goat (Table 1). Skins are exclusively used in the manufacture of various types of leathers, which, in turn, are converted into consumer products such as shoes, gloves, and handbags. A substantial proportion of the intestines is used in edible products and sausage casings; the balance is used to produce surgical guts and, to a small extent, sports and musical

<table>
<thead>
<tr>
<th>Product</th>
<th>Value (INR)a</th>
<th>% of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat</td>
<td>360</td>
<td>78.3</td>
</tr>
<tr>
<td>Skin</td>
<td>55</td>
<td>12.2</td>
</tr>
<tr>
<td>Liver</td>
<td>14</td>
<td>3.0</td>
</tr>
<tr>
<td>Head and legs</td>
<td>20</td>
<td>4.3</td>
</tr>
<tr>
<td>Stomach</td>
<td>8</td>
<td>1.7</td>
</tr>
<tr>
<td>Blood</td>
<td>2</td>
<td>2.4</td>
</tr>
<tr>
<td>Intestine</td>
<td>1</td>
<td>0.25</td>
</tr>
</tbody>
</table>

aIn March 1988, 12.2 Indian rupees (INR) = United States dollar (USD).
guts. Blood is partially recovered in some areas; otherwise, all the blood is allowed to drain away. The other products (head, legs, and liver) are edible items. Theoretically, it is possible to recover and process items like bile liquid, horns, hooves, and ruminal contents; however, on a commercial scale, these products are not being recovered because of various constraints such as limited availability, collection problems, and limited demand.

Production of goat skins

Because of the religious inhibitions on the consumption of beef among Hindus and the consumption of pork among Muslims, India depends largely on goats and sheep. Goat meat production accounted for 30.4% of the total meat produced in 1985 (ECMI 1987). Furthermore, India has the highest slaughter rate of goat in the world (67.9%). According to a recent survey (CLRI 1987), about 69 million goats were slaughtered in 1986; 50% were slaughtered in urban areas and 50% were slaughtered in villages throughout the country. As far as goat skins are concerned, their recovery is almost complete. Through a network of collection systems, the skins are mobilized from distant rural areas, semiurban areas, and urban centres to various markets in the country from where they are dispatched to different tanning centres. There are seven important terminal markets for goat skins operating in India, with an annual turnover ranging from 1 million to 12 million pieces; another 15 markets have annual turnovers ranging from 0.5 million to 1.0 million skins (Table 2). In addition, there are several markets operating below 0.5 million pieces/year throughout the country at regional and subregional levels.

Table 2. Important terminal markets for raw goat skins.

<table>
<thead>
<tr>
<th>Market</th>
<th>Annual turnovera</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcutta (West Bengal)</td>
<td>12.0</td>
</tr>
<tr>
<td>Delhi</td>
<td>7.2</td>
</tr>
<tr>
<td>Chengannacherri (Kerala)</td>
<td>3.7</td>
</tr>
<tr>
<td>Bombay (Maharashtra)</td>
<td>3.5</td>
</tr>
<tr>
<td>Kanpur (Uttar Pradesh)</td>
<td>2.9</td>
</tr>
<tr>
<td>Hyderabad (Andhra Pradesh)</td>
<td>2.5</td>
</tr>
<tr>
<td>Solapur (Maharashtra)</td>
<td>1.3</td>
</tr>
<tr>
<td>Ahmedabad (Gujarat)</td>
<td>0.9</td>
</tr>
<tr>
<td>Yedsi (Maharashtra)</td>
<td>0.8</td>
</tr>
<tr>
<td>Jaipur (Rajasthan)</td>
<td>0.8</td>
</tr>
<tr>
<td>Faizabad (Uttar Pradesh)</td>
<td>0.8</td>
</tr>
<tr>
<td>Madras (Tamil Nadu)</td>
<td>0.8</td>
</tr>
<tr>
<td>Lucknow (Uttar Pradesh)</td>
<td>0.7</td>
</tr>
<tr>
<td>Surat (Gujarat)</td>
<td>0.7</td>
</tr>
<tr>
<td>Amritsar (Punjab)</td>
<td>0.7</td>
</tr>
<tr>
<td>Guwahati (Assam)</td>
<td>0.7</td>
</tr>
<tr>
<td>Vijayawada (Andhra Pradesh)</td>
<td>0.6</td>
</tr>
<tr>
<td>Muzafarpur (Bihar)</td>
<td>0.6</td>
</tr>
<tr>
<td>Darbhanga (Bihar)</td>
<td>0.6</td>
</tr>
<tr>
<td>Guntur (Andhra Pradesh)</td>
<td>0.6</td>
</tr>
<tr>
<td>Chauri-Chaura (Uttar Pradesh)</td>
<td>0.5</td>
</tr>
<tr>
<td>Patna (Bihar)</td>
<td>0.5</td>
</tr>
</tbody>
</table>


aMillions of pieces.
Preservation

Skins are cured to prevent them from decaying before tanning. For this purpose, wet salting of the slaughtered skins is widely practiced. Depending on the duration of storage and the season, further saltings are given at different points in the market chain. Skins produced in the Himalayan region are flint dried because of the problems of salt transportation and storage. The proposition of such skins, however, is limited.

Production to processing

The duration between the procurement and the processing of the skins depends on season, distance, length of market chain, hoarding practices, etc. In general, the time lag is longest in the winter and shortest in the summer. Skins procured in urban centres are transported within 2 weeks to the tanneries. With skins from rural areas, the time lag may reach 2 months depending on the distance and number of stages involved in the market chain.

Price markup

In the market network, many middlemen are involved in the collection, preservation, transportation, and trading of goat skins. At each point in the chain, the skin gains additional value depending upon the inputs, storage period, and margin of profit to the seller.

The longer the chain, the higher is the ultimate price markup over the basic procurement price. With respect to the slaughtered skins from urban centres, the role of the middlemen is limited and the primary producer gets a fair price; the rural producer, however, being ignorant of prevailing market prices, remains in a disadvantageous position. In addition, the habit of accepting payment in advance cripples the bargaining power of the primary producer. The price markup of goat skins at the tanners' stage can reach 45% over the price originally paid to the primary producer at the village (CLRI 1987). This price markup varies from market to market and depends on the number of middlemen involved.

With the structural changes taking place in the leather industry with the establishment of more finishing units and the growing export trade, the raw material market structure is undergoing improvements. The market chain is becoming shorter and the role of the middlemen is gradually reducing. In certain terminal markets, the raw hide and skin dealers now convert raw materials into semitanned leathers and sell them to the finishing units. Some of the leading tanners have opened direct procurement centres in various markets. All these developments have changed the market structure to the benefit of both the producers and the consumers.

Value addition at different stages of processing

Enjoying low-cost labour, favourable licencing policies for setting up production units, and export incentives, since 1974 the Indian leather industry has established many processing and finishing centres in selected areas of Tamil Nadu, Uttar Pradesh, West Bengal, and, to some extent, Maharashtra. The value addition that accrues at different stages of processing and conversion is as follows (raw materials = 100): vegetable-tanned and chrome-tanned leathers, 150; finished leathers, 225; leather products, 450. The important tanning materials for vegetable tanned leathers are wattle, avaram, and myrobalan nuts and babul bark.
For many years, these leathers have enjoyed an international reputation for their quality, colour, and other properties. Similarly, unfinished chrome-tanned leathers produced mainly in West Bengal, Uttar Pradesh, Maharashtra, and Tamil Nadu are marketed mostly in East Europe.

Both vegetable-tanned and chrome-tanned unfinished leathers were produced mostly for export until export regulations were introduced in 1974. An export duty of 25% on the free-on-board value and quota restrictions were introduced to phase out these exports. Simultaneously, a package of export incentives on finished leathers and products was introduced. Encouraged by these incentive programs, both horizontal and vertical expansion of the finished leather and leather products sector took place. Entrepreneurs from other industries and technocrats entered into this field. The necessary research and development inputs and technical know-how have been provided by concerned institutions. The important goat skin based products that are now exported include glazed-kid glove leathers, soft leathers, footwear uppers, and high value added fancy goods (e.g., ladies handbags, garments, gloves, etc.). As a result, the value of exports of goat skins and their products have gone up from INR 973 × 10^3 in 1973–74 (40 × 10^6 pieces) to INR 3000 × 10^3 in 1985–86 (50 × 10^6 pieces) (CLRI 1974). In 1985/86, goat skins and derived products accounted for 45% of India’s total exports of leather and allied products (CLE 1987). About 66% of the total production of goat skins is now exported in some form. In 1985/86, 95% of the total export earnings from goat skins represented finished leathers and products; in 1973/74, these products accounted for 11%. These changes in the export structure more or less reflect corresponding changes in favour of industrial development that have taken place in the processing sector based on goat skins.

**Blood**

Blood accounts for 3.5–5.5% of the body weight of the animal. It is rich in protein and iron and, for this reason, blood is sometimes obtained from the slaughtered animal and used for consumption. On average, raw blood contains 80% water and 20% solids. In conventional slaughtering, the animal falls to the ground and the throat is then slit. In India, most slaughterhouses are not well equipped for the collection of blood. In addition, religious sentiments against the collection of blood are prevalent. As a result, the blood is either entirely lost or only a portion is collected. The hasty slaughter and growing congestion in slaughterhouses further inhibits effective blood collection. As a result, only 30–40% of the blood is being recovered from the slaughterhouses (CLRI 1987). The blood collected is used for consumption; in rural areas, this is quite popular. Muslims do not collect or utilize blood.

With the anticipated modernization of slaughterhouses in the urban centres and with the establishment of viable rural slaughtering in the years to come, blood collection is expected to improve. Proven technologies are available in India for the conversion of blood into valuable blood albumin, serum, and plasma, provided clean environment facilities for refrigeration are present in the slaughterhouses. Blood mixed with wheat bran or with treated “ruminal contents” (blood meal) is used as an animal feed supplement. Mixing blood with a less fibrous bran is more desirable for poultry feed than mixing with dried ruminal contents.
Bile

Bile liquid is another by-product that can be collected from goat (20–50 mL/animal). Muralidhara Rao (1986) observed that it is quite simple to convert the bile liquid into a paste that can be preserved. From this paste, cholic acid can be derived. In India, however, the recovery of bile in commercial slaughter-houses is not economically feasible because of the hasty slaughter and handling of the carcasses.

Intestines

Although India has a strong potential base with 69 million intestines from slaughtered goats in 1986, their recovery for the manufacture of specialty items (e.g., sausage casings, surgical guts, etc.) is limited for the following reasons:

- 50% of the total goat slaughter occurs in urban areas;
- Not all slaughterhouses in the urban centres are equipped with facilities necessary for the hygienic recovery of by-products;
- With the rising prices of meat, the diversion of intestines for consumption (along with the meat) is increasing;
- The butcher gets a better price if the intestine is sold for consumption, irrespective of quality;
- For sausage casings or conversion to cat guts or sports guts, intestines with a specific diameter and length are preferred;
- The overseas demand for Indian wet-salted casings is stagnant; and
- Special skills are necessary for processing intestines into value-added products.

In India, only in the urban centres, where sizeable production is occurring, is intestine processing continuing. To make casings, several operations such as pulling, strapping, fermentation, slimming, and scrapping are necessary (Mahendra Kumar 1981). Wet salting is performed using fine salt and rubbing it liberally on the rings and hanks. The salted casing is kept in a wooden bin with a perforated bottom, permitting the drainage of brine. Salting is considered complete when the formation of brine ceases. This may take 2 or 3 days. An improved process was developed by the Central Leather Research Institute to produce “dry ready to wet casings” free of fats and other unwanted appendages. With this process, white, light casings that can be stored for any length of time without deterioration can be obtained. These improved casings are suitable for dry filling, which facilitates wetting for sausage-making. The Central Leather Research Institute also developed technology for converting intestines into surgical cat guts. This technology has been transferred to industry. It is estimated that the annual value of cat gut production using this technology could be INR $12 \times 10^6$; this is a significant increase over the present annual cat gut production of INR $30 \times 10^6$. During 1984–85 about INR $40 \times 10^6$ worth of goat guts (for food casings) and INR $1.4 \times 10^6$ worth of surgical cat guts (from goat skin) were exported (CLRI 1985).

Intestines were used in the production of sports guts and musical strings. This industry is gradually dwindling, however, because of the substitutes emanating from nylon products and the high price of raw materials. A paucity of information
exists on the production of intestines in different regions, their categorization according to quality, the pattern of utilization, centres of processing, etc., and this hinders further analysis into the economics and marketing aspects of this material.

**Conclusions**

The importance of goat as a source of income to the farmer, a source of meat for human consumption, and a source of raw materials for the leather industry is increasing in India. Alternative models for developing goat under different systems of farming are being tried to evaluate their technoeconomic efficiency. In India today, hygienic meat production and meat handling systems are becoming important.

Attempts are being made to set up modern slaughterhouses in urban centres to ensure better handling of meat production and to recover slaughterhouse by-products under hygienic conditions. Like milk production and distribution, it may be possible to set up viable, rural, small, modern slaughterhouses and distribute the meat both in urban and rural centres. This model of development has the definite advantage of retaining the skin, blood, intestines, and ruminal contents in the rural areas and processing them close to the slaughterhouses without resorting to preservatives, etc. Apart from providing rural employment, this model avoids the use of salt, which becomes a pollutant in the process downstream of the by-product.

Export policies have been streamlined to encourage the export of high value added leather products and discourage the export of other less value added items. Thus, if the present line of thinking about the development of the meat industry and the processing of by-products takes concrete action, substantial wealth can be recovered based on the exploitation of goat-based slaughter by-products. The knowledge of the present status of production and handling systems of by-products, however, is limited. The information gap could be filled through a systematic, nationwide, technoeconomic survey on the present status of slaughterhouses and the recovery and utilization of slaughterhouse by-products. This study should also enumerate the processing units engaged in casings and gut manufacture, their volume of production and marketing, and identification of problems and prospects for accelerating their growth. In the interest of the national economy, it is essential to have an overseas market survey to assess the export potential for the country's products. It will be to the mutual advantage of the countries having sizeable goat populations to exchange information on different aspects of processing and marketing by-products.

**Acknowledgments**

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