PASTORAL CAMEL HUSBANDRY PRACTICES IN KENYA

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Acknowledgement

The Manual “Pastoral Camel Husbandry Practices in Kenya” is a product developed based on experts’ opinions and local pastoral communities’ in Kenya. The findings, analysis and recommendations are those of author and cannot be attributed to IDRC or to its Executive Board.

This manual is intended to raise awareness among pastoral communities in Kenya who are non-camel keepers as well as camel keepers who may need additional knowledge or skill in camel husbandry.

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Forward

Socially Inclusive Adaptation Knowledge Integration for Resilience Livelihood in Northern Kenya (SOAK) project aims at supporting pastoralists and agro- pastoralists to use transformative and socially inclusive adaptation knowledge to build the resilience of their livelihoods and landscapes in northern Kenya, particularly in Isiolo County. The project is anchored on lessons and recommendations derived from previous research work undertaken by Adaptation at Scale in Semi-Arid Regions (ASSAR) in the area. Communities in the region continue to remain vulnerable to impacts of climate change despite efforts by development agencies both in government and non-governmental organizations to build their resilience. This project intends to actualise knowledge into action on some of the research outcomes. Among challenges identified and are being addressed under this project included 1) Existing barriers to integration of adaptation knowledge from different sources thought to be impediment to adoption by local communities for timely decision making and building resilience and 2) Livelihood diversification is often promoted as an adaptation and risk management strategy, yet what people diversify into is critical.

Pastoral Camel Husbandy Practices has been developed to address the challenges associated with livelihood diversification. The pastoral communities (Borana) in Isiolo County identified diversifying livestock species to include camels as one way of building their resilience to climate change hazards. Borana community being predominantly cattle keepers have limited knowledge and skills on managing camels. This manual therefore was developed to help pastoralists gain useful practical skills for rearing camels.

This manual is an extension guide for use in teaching and learning basic knowledge on camel management practices but also provide do-it yourself steps in managing certain situations such as identifying various breeds, pests and disease control practices as well as best practices in handling camel by-products.

The Manual is divided into six broad sections to address as key topics essential for those beginning to rear camels for the first time. Attempts have been made to simplify the information as well as use images as much as possible. To make it relevant to the targeted regions, local names for diseases, pests, forage plants among others have been used for ease of identification and application. This manual is not exhaustive in its coverage, and therefore consulting experts as well as other sources is encouraged.

It is my expection that by using these manual pastoralists will be able to increased productivity from species diversification, maximum use of rangeland as well as built their resilience while adapting to climate change impacts.

Contents

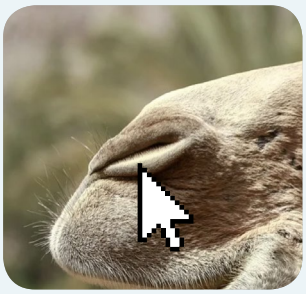
Section I: Background

Camels are domesticated animals found mainly in arid and semi-arid environments of the world. There are two species of domesticated camels; one humped dromentary, and two humped Bactrian camel. The one-humped dromentary makes up 94% of the world's camel population, while two-humped Bactrian camel makes up 6%. In Kenya, only one-humped dromentary species are kept mainly in northern Kenya. As at 2019, it was estimated that there are 4.6 million Camels in Kenya predominantly in northern eastern and coastal regions.

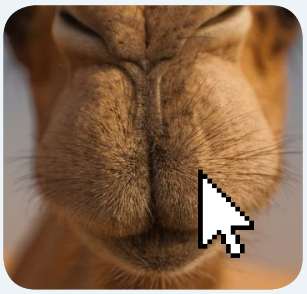
Camel Adaptations to arid conditions

The camel unlike other domestic animals has about twenty adaptations for survival under conditions of heat, drought and water deprivation. These adaptations enable it to survive and access remote pastures. Thus, it is able to produce during drought when other animals stop lactating or even die

Anatomical adaptations of camels include long legs that lift their bodies well above the hot ground, sternal pad that keeps a camel's body above the ground when seated, nostrils that can close against dust, large padded feet to support their weight in sand, long eyelashes and a membrane to protect the eye against dust



Closed Nostrils



Split lips

long eye lashes

Physiological adaptations include fat stored in the hump during times of plenty to be used in times of need, the fat also insulates a camel's back from high mid-day solar radiation. Camels breathe slowly and so loose less moisture from the lungs while some moisture condenses in the nostrils. Body heat is lost through blood vessels near the skin. Camels urinate down their hind legs, which help in heat loss when it evaporates, they can lose 25% of their weight in water but their blood remains fluid; they can drink a large volume of water (at least a third of its body weight) at one watering without any problem. Their red blood cells may swell several times their normal size after drinking without rupture ('does not suffer water poisoning'). Camels may allow their body temperature to super-heat by 6 degrees centigrade before sweating and also super cool at night. Their kidneys are highly efficient producing concentrated urine and they may recycle urea and they may also produce very dry faeces

Behavioural adaptations include sitting while facing the sun so as to expose a minimal surface area to the sun to avoid rise in body heat and subsequent water loss through sweating

In the face of global warming and all the associated problems, it is anticipated that the camel will be a key animal for pastoralists to keep in the future, if they are to have meaningful and successful livelihoods in the arid lands of Kenya

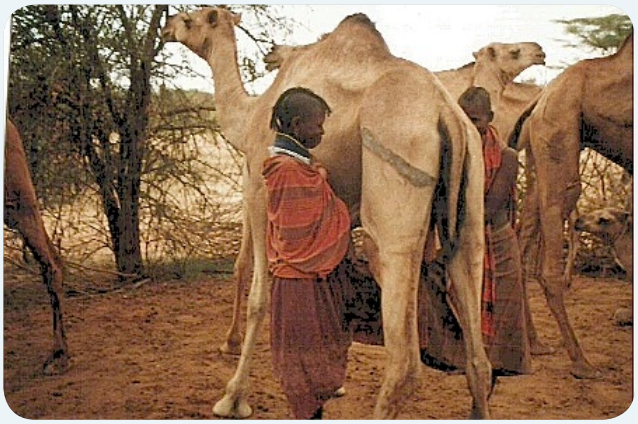
Section II: Importance Of Camels

Key products derived from camels are milk, meat, hides, and bones which were previously used for subsistence but are increasingly being commercialised. Untapped potentials are also being explored. Such initiatives include value addition along the market chain, ecotourism, and draught power.

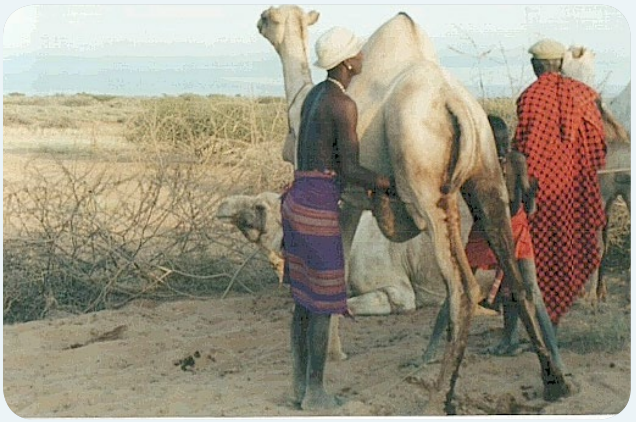
Milk

Camels are kept mainly for milk. sometimes referred to as 'the white Gold of the desert'. However. The high vitamin C content in camel milk is of great advantage to ASAL dwellers who have limited access to fruits and vegetables. It is also believed to have medicinal value e.g. beneficial effects in management of high blood pressure, diabetes etc. Other qualities of camel milk include;

- Colostrum is white and less concentrated
- The milk is white, frothy especially in healthy camels and the taste varies with vegetation.



Turkana girls milking a camel



Rendille elders milking

Work and Transport

Pastoralists use male camels mainly for drawing water, carrying their houses and other belongings, shifting young children, old people and young stock and ferrying surplus milk to the market

Gabbra camel carrying water

Desert ambulance

Camel ploughing on Mt Marsabit

Tourism, Mobile Services and Sports

Camel racing and trekking safaris have great potential to earn the owners and trainers income from eco-tourism. Parts of northern Kenya and Rift Valley are highly suited to this as they may offer a combination of wildlife and mountain scenery. Camel racing in Kenya is still in its infancy,

Turkana girls milking a camel

Camels could also be used to provide mobile special outreach services such as carrying tourist, CASPROs and Village Health Assistants to remote destinations with their equipment

Social and cultural uses

Camels play an important role as a medium for regulating most aspects of socio-cultural and religious lifestyles of camel keeping communities. A man without camels is like a cripple because he. cannot shift with the rest of the community, draw water from far distances or provide enough for his family especially during drought

A family without camels is considered to be poor, in spite having other livestock species. The camel is regarded as a symbol of wealth, status and prestige. For example, amongst the Somali pastoralists, families or clans with large camel herds are regarded as being wealthy with a higher social status and influence, and often become opinion leaders within the community

The culture of most indigenous camel keepers revolves around camels e.g. Rendille and Gabbra regularly perform traditional ceremonies for blessing camels i.e. the *Sorio.* Camels are required in important ceremonies such as marriage, burial and religious events. Among the Somalis, camels are used to pay Zakat (tithe or offering) In fact camels are becoming mandatory species for dowry payment even among communities that have recently adopted camels such as the Samburu. There are many cultural dances in praise of camels

Camels are used as medium for settling damages caused by conflicts between individuals, families or clans. For example, among the Somalis, compensation for the death of a man and woman is still 100 and 50 camels, respectively according to the Madogashe declaration

Camels are seen as a store of wealth, investment and banking system or security against drought, disease and other natural calamities. In some communities, camels are also loaned to the needy as a way of spreading risks and assisting others

Section III: Camel Breeds In Kenya

There are three camels breeds in Kenya, namely Somali, Rendille/Gabbra and Turkana. These breeds derived their names from communities who rear them. There is also a Pakistani, a breed imported from Pakistan into Laikipia ranches in Kenya in the early 1990s, although only few pure Pakistan camels exist at the moment.

Somali breed

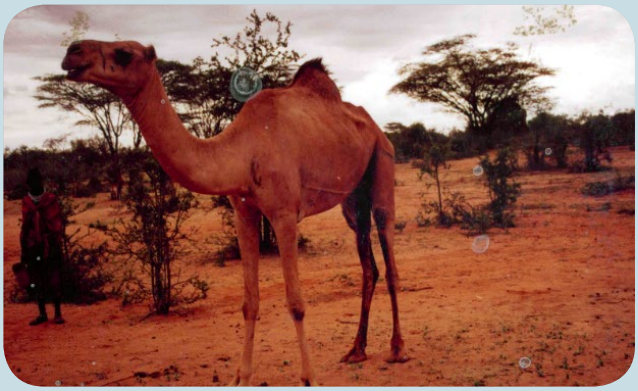
The Somali breed has the following characteristics;

- Largest in body size (450 - 850 kg)
- Daily milk yield of 3 - 5 litres
- Heavy feeder
- Not suited for hilly terrain because of the weight
- Largely creamish in coat color

Rendille/Gabbra breed

Compared to Somali breed, Rendille/Gabbra breed has is;

- Smaller in size (300 -550kg)
- Lower in milk yield (average 1 - 3 litres daily)
- Does better under poor pasture conditions and rough terrain
- Coat color is mainly cream or brown



Turkana breed

The Turkana breed has the following characteristics;

- Smaller in size (250 – 500)
- Lowest in milk yield (1 – 2.5litres daily)
- It can do well under poor pasture conditions and rough terrain
- Coat color is mainly grey

Section IV: Camel Breeding

Sexual maturity

- Females become active at 4 to 5 years of age and give birth when about 5 to 6 years old.
- A male on the other hand attain sexual maturity at around 5 years but begins to serve actively at around 6 years when his canine teeth are sufficiently developed for fighting.

Recommended bull: female ratio

- Normally a camel keeper should maintain one dominant bull of between 6 to 12 years with one younger bull as his replacement,
- More than one breeding bull may be required depending on the herd size,
- A bull: female ratio of 1:50 is appropriate when sufficient forage is available.

Rut in Males

- Loss of appetite and condition
- Unusually aggressive and difficult to handle (Chases away all the other males and even humans)
- Frequent urination and splashing urine on the back by flicking the tail.
- Prolific secretion from the poll glands situated behind the ears and rubbing the secretion onto plants as a way of marking its territory
- Protrusion of a soft palatal flap from the mouth (with air, in form of a pink balloon as shown in the picture below)
- Making characteristic noises and continuously grinding their teeth with saliva flowing from the mouth
- Rutting bulls should be separated as they may fight to death.

Rutting Rendille Bull
Notice the protruding swollen tongue

Signs of heat in female

- She may become restless
- May show swelling of the vulva and mucous discharge
- Frequent urination
- Making characteristic noise
- May have reduced milk yield
- May sniff urine from other females

The heat is repeated after 20-25 days for females that fail to conceive.

Pregnancy diagnosis

- A traditional method of telling if a camel is pregnant, is to stand near it and raise your hand, then check for the raising of the tail and passing of some urine. If it does so, this indicates pregnancy.
- A pregnant camel will also raise her tail when a bull approaches her,
- The camel begins to show this sign 2-4 weeks after conception.

Tail raising- sign of pregnancy

Good Breeding Practices

Inbreeding

Avoid inbreeding by:

- Replacing the breeding bull at 12 years when its first daughters become sexually mature
- Exchanging bulls with neighbours
- Use of two or more breeding bulls

Use young bulls below 13 years. Such bulls have;

- High ability to follow and mount females
- High service rate
- Come to rut faster after the dry season and serve for a longer period in any given breeding season
- Higher conception rates of females availed for service

Use females of less or equal to 6 calvings. Such younger females;

- Normally have good body condition
- Produce more milk for the calf and humans and their calves show higher growth rate

- Use of the bull approach to spread desired features in camel herds
- Bull approach is faster in spreading the desired traits because one breeding bull has capacity to serve 50 dams in a breeding season while a female would only give birth to one calf at a time

Signs of labour

- Enlargement of the udder
- Sagging of the ligaments at the root of the tail
- Restlessness including lying down and standing up
- Loss of appetite
- Make characteristic noise
- Isolating themselves from other camels

Calving Management

- Separate the camel from the rest of the herd and keep it in the boma
- Be near the camel
- In case of difficult calving, gently manipulate
- Make the mother lie down to ensure that the calf is not dropped while the mother is standing
- Remove birth fluids on the calf body particularly around the nose
- Treat the cut end of the umbilical cord with some iodine, strong salt solution or just tie it in a knot or with a clean string
- Put the calf in front of the mother until the mother makes some low groaning noise
- Assist the calf to suckle and if the mother refuses to suckle her calf which is especially common with first calvers, smear the mother with some birth fluids around the nostrils. If she still proves difficult, isolate and try to scare her so that it only sees the calf around her. This helps in forcing the mother to accept the calf. In case of death of the mother, cover the foster mother with the hide of the mother to enhance acceptance.
- Note: If mother dies before two months post birth, the calf rarely survives
- Must witness dropping of placenta although retention is very rare; can also be removed manually

Feeding and Nutrition in camels

Nutrition- very important for growth, reproduction and milk production.

Good nutrition implies that the camel must get sufficient proteins, energy, roughage, minerals and water.

Feeding habits

Young camels begin to browse at the age of one month. Foraging camels spread over a large area thus minimizing pressure on a particular area. Their long legs and neck enable them to browse up to 3 m above the ground, a height not reached by other livestock.

Due to their specific forage preferences and feeding at higher levels, camels are rarely in direct

competition with other animals (notably cattle and sheep) for grazing and therefore a combination of these species results to increased productivity per unit of land.

Given the opportunity, camels prefer to feed on shrubs and trees. However, in the absence of browse forages they can comfortably live on herbs and annual grasses.

A camel requires 8-10 hours of grazing daily to be satisfied. This depends on breed, body size and feed availability. In an ideal situation, camels are able to select a high-quality diet that provides all the nutrients required by the body.

During the dry season, when other forages are scarce, camels can browse on the green tips of trees that other livestock species do not, enabling them to survive droughts.

It is worth noting that there are some plants that can poison camels e.g. (*Capparis tomentosa* and *Solanum spp*

Some preferred plants include: *Acacia tortilis* or Abuk (Somalia); Dahar (Rendile) Ltepes (Samburu); Etir(Turkana); Dadacha (Gabbra);

Acacia nilotica: Mado (Somali); Gilorit(Rendille); Ekalapelimet(Turkana); Ilkiloriti(Samburu)

Mineral requirements

- Camels prefer browsing on salty plants
- Pastoralists are aware and seek natural sources
- Suggested salt allowances under normal dryland conditions range between 30 and 60 g/day.

Water requirements

The camel is the most efficient livestock in water utilization in the body by being able to reabsorb most of the water in the kidney, avoiding water loss through evaporation, among others. Water requirements in camels depend on the water content of the forage and accessibility to water.

Camels get sufficient water from the feed in wet seasons and may not require direct watering.

Dry seasons and drought periods: watering camels is required at intervals not exceeding 5 to 8 days. Lactating camels should be watered at least every six days with adequate forage available.

Camels can drink up to 25% of their body weight within a few minutes, however ample time should be given to the camel to drink several times with resting intervals to meet its requirements.

Dehydration in camels can be tested by the skin elasticity by pulling out the loose skin e.g. the neck or lower part of the abdomen and then release. If the skin reverts back to it normal position quickly, it suggests that the animal may not require water. However, if the skin takes long to revert to its normal position, this suggests significant degree of dehydration.

Supplementary feeding in camels

Under normal circumstances camels, can get enough and quality diet from natural vegetation. However during periods of feed scarcity, supplementary feeding would certainly be beneficial to camels particularly pregnant, lactating and calves.

- Supplementation can be achieved through harvesting and storage of some feed material e.g. acacia pods especially for the settled households.
- The nutritional quality of natural vegetation is highest at the time when vegetation is beginning to dry up and this would be the most appropriate harvesting time.
- Grass hay, minerals supplement and concentrates like dairy cubes could be bought from the market and fed to camels. However, this may prove expensive and only affordable for a few high yielding breeds like Pakistani.

Section V: Camel Pest And Diseases

Camels like other livestock are affected by a number of pests and diseases. In this guide, only common pests and diseases in Kenya are described.

Pests

Camel Mange

Local names: *Lpepedo*, (Samburu); *Emitina*, (Turkana); *Adho, Chitto, Addha* (Somali); *Haddo* (Rendille); *Simpirion* (Pokot). *Chitto* (Gabbra, Borana)

This is a parasitic skin mite (*Sacroptes scabei var. cameli*) common during wet season.

Signs

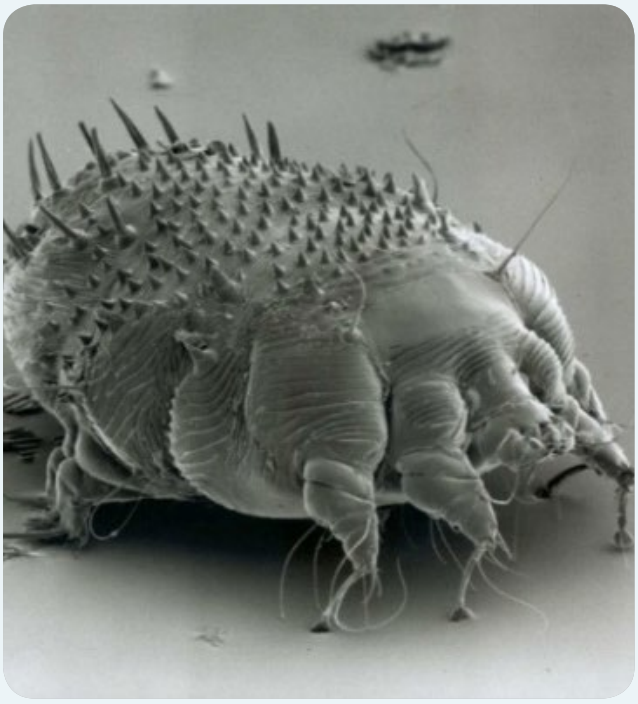
- Severe itching especially early morning
- Hair loss from head to rest of the body
- Dead skin scabs
- Skin thickening appearing like elephant/rhino skin

Mode of Transmissions

- Through direct contact with infected animals, contaminated surfaces such as tree trunks where infected animal rub itself, and/or contaminated boma

Treatment

- Its often difficult to treat once fully established. Use Ivermectin 1%, two doses for 8 days



Tick infestation

- **Local Names:** *Shilmi, Chilim, Yagar, Yakhal* (Gabbra); *Shilim, Chillim, Turdach* (Rendille); *Shilin, Yakhal* (Somali); *Ilmangeri, Lmanjeri, Imansher, ltunturi* (Samburu), *Ngimadang, Emadang* (Turkana), *Shini, Shelem* (Borana)
- Many ticks attached at tail, neck, armpit teat
- loss of blood (anaemia), loss of weight
- skin wounds
- Stunted growth

Gastrointestinal worms

Local Names: *Ntumai* (Samburu); *Goryan, Bahala* (Somali); *Ngirtan, Nyiritan* (Turkana); *Deyah* (Rendille), *Mini* (Gabbra); *Chepturu* (Pokot); *Minyoo* (Swahili).

Signs

- Presence of parasitic worms in stomach and intestines
- mainly diarrhoea,
- rough hair coat, bloated abomasum,
- chronic weight loss, stunted growth in young camels

Treatment

Oral dewormers given as a drench or bolus (e.g, Albendazole.

Hydatidosis

Local Names: *Mbolimboli* (Samburu); *Labusiyon* (Turkana) **Definition:** Infectious parasitic disease causing round swellings (cysts) mainly in the liver and lungs.

- Camel grazes in pasture contaminated with Tapeworm *(Echinococcus granulosus)* eggs shed in the faeces of dogs and other carnivores (eggs are

Signs

- microscopic i.e. invisible). These eggs once eaten by camels develop into cysts in the liver, lungs and other organs seen when camel is slaughtered. Affected camels can show chronic weight loss. If cyst is located in the brain camel shows central nervous signs (e.g. circling movement. All age groups are affected and it can occur any time of the year

In control,

- Do not consume raw meat!
- Do not feed dogs with organs or any slaughter offal, unless the meat inspector has confirmed that the camel is free of cysts!
- At slaughter, bury or burn organs with cysts so that dogs and other carnivores cannot eat them.
- Deworm your own dogs regularly against tapeworms, read instructions to confirm that the dewormer you use is effective against tapeworms (some dewormers only cover roundworms).

Note: The eggs can also be eaten by humans who develop cysts as in the camel and is difficult to treat

Diseases

Anthrax

This is an Infectious disease affecting both human and animals. It is caused by a bacteria called *Bacillus anthracis*. It can kill camels

Signs

In very acute form Anthrax can kill a camel without any symptoms.

In the acute form

- Fever, bloat, diarrhoea, irregular and fast breathing convulsions & dead
- Un-clotted dark tar-like blood coming out of all body openings which remain liquid
- The carcass does not become stiff
- The carcass decomposes fast

In sub-acute form

- Painful swelling of head and neck,
- Swelling (*edema*) of the tongue,
- foamy blood coming from the mouth.

This form can go on for several days before the animal dies. Mainly common during the dry season and all ages are affected

Treatment

- When detected early, Penicillin- Streptomycin combination antibiotic is used (doubled dose) for at least 5 days.

Prevention/Control

- When anthrax is suspected, do not open the carcass.
- Dispose off carcasses through burning or burying.
- In cases where this is not possible, guard the carcass against being opened by scavenger.

Note: Humans can be affected though contact with infected carcass, through consumption of infected meat or when handling hides and skins

Camel pox

Local names: *Names Furuq, (Somali); Chito (Gabbra); Afturo (Rendille); Abturo (Samburu); Ekolimeri (Turkana)*

This **is** a highly infectious skin disease causing typical pox lesions
Severe form- Fever, animal is very dull, no appetite, swelling of the head
Pox lesions all over the body.

Mild form- pox lesions are found only around nose, mouth, eyes and under the tail.
Caused by poxvirus common in wet season. Most common in 1 to 3 years of age.

Start as small red patches; they swell and become liquid filled pustules (the pox), these then rupture and turn into blisters, the blisters can become infected by bacteria and start producing pus. Healing takes 4-6 weeks and the camel can become very weak. There is no treatment as it is a viral disease

Rabies

Local Name: *Nyanye* (Gabbra, Borana), *Sugere Kaar* (Rendille), *Nkwang* (Samburu), *Ruqus* (Somali), *Ingerep, Arthim* (Turkana).

This is a viral disease caused by rabies virus and is characterized by nervous signs and abnormal behavior. *Transmission***:** through bites and saliva of sick animals especially dog bites;
if a camel with rabies bites other camels or people they also get infected by rabies. It affects all ages of camels

Signs

- camels aggressive and attack others.
- Excess salivation and are not able to drink or swallow.
- Bulls show hypersexual behaviour. After some days, they become weak and unable to stand. All affected animals die.

Note: There is no recovery from Rabies

Wounds

Local names: Madaa (Gabbra); Ngoldonyot (Samburu); Boog (Somali); Ngajemei (Turkana).

Signs

These are open wounds, broken skin, lameness, secret pus bad smell, physical injuries from thorns, fighting between bulls, beatings, predator attacks, castration and branding.

They have secondary bacterial infection fly maggots can infest open wounds.

Transmission

- Occurs through contact with pus.
- Bacteria are also spread by flies feeding on open wounds;
- Flies can also lay their eggs into wounds – larvae ("maggots") grow inside the wound, leading to very serious, sometimes deadly infections. This is also called Myiasis caused by *Cephalopina titillator* and all ages are affected. Occurrences are more common in the wet season when the number of flies is high

Treatment

Clean with antiseptic (e.g. hydrogen peroxide), apply iodine once daily. For superficial fresh wounds, aerosol spray (e.g. gentian violet) is sufficient.
Large infected wounds need supportive injection of antibiotics (e.g. Penicillin-Streptomycin or Oxytetracycline 20% LA.

Abscesses

Local Names: Kharfat (Rendille); Maala (Gabbra,); Mala, Mall, Arno (Somali); Ngubuthien, Abus, Adjumei, Lobus (Turkana); Ntubui, (Samburu).
These are swelling of parts of the body (mainly skin and lymph nodes, but also udder and parts of internal organs) with pus accumulation.

Signs

- First warm, swollen and painful; later the hard swelling becomes soft and there is no heat or pain; after 3-4 weeks,
- Abscesses can burst and discharge pus. External (very common)

Treatment
When the abscess capsule becomes soft, make a cross-shaped cut with a clean scalpel blade at a low point to allow the pus to drain out. Flush it with Hydrogen Peroxide, Iodine or Gentian Violet and repeat flushing for several days. In severe cases, especially in calves with several abscesses around joints, inject Penicillin –Streptomycin combination medicine daily for 5 days. Internal abscess: No effective treatment; antibiotics cannot penetrate the abscess capsule. Internal abscesses are only seen after death or at slaughter.

Respiratory Infection and Pneumonia

Local Names: *Qufa, Kufa', Furri* (Gabbra); *Dahassi, Yaharr* (Rendille); *Laxawgal, Ah, Dhugato, Dugub, Erghib, Kharid Dugub, Ooof* (Somali); *Loukoi, Lotai* (Turkana); *Nkorroget, Loroget, Lchama, Ibus bus* (Samburu).

Pneumonia refers to inflammation in the lungs.

This condition occurs in camels of all ages and can be caused by a wide variety of viruses, bacteria and fungi and worms whether singly or in combination. It can also be induced mechanically by wrong drenching causing aspiration pneumonia.

The main predisposing conditions to pneumonia are sudden climatic changes, poor management practices and poor nutrition. Weaning or diseased camels are especially vulnerable and pregnant camels can abort. Though there is low morbidity and mortality, recovery can be very prolonged

Acute outbreaks are manifested as increased rate of breathing, wheezing, serous nasal discharge which can proceed to purulent discharge associated with secondary bacterial infection, fever, anorexia, depression and a reluctance to move. Eye discharge and postural changes like abduction of the elbows, extended neck, deviated carriage of the head with apparent swelling of the temporal region or above the frontal sinus may occur. On percussion, the pus-filled sinus will sound full or solid.

Chronic cases of pneumonia are characterized by weight loss and intermittent fever. Such animals are prone to other subsequent infections. For confirmation of diagnosis, bacteriological isolation is necessary.

Treatment
For bacterial infections, long-acting antibiotics are normally effective if started early. Fistula formation between the sinus and the nasal cavity is a common finding in most cases of sinus infection. Drainage is normally sufficient. In case of nasal airway obstruction due to purulent discharge, relief can be achieved by regular flushing of the nasal cavity with saline and recovery is common.

Diarrhoea

Diarrhoea in suckling camel calves (up to 3 months of age) Diarrhoea is a sign of a problem in the alimentary system

Local Names: *Halbathi* (Gabbra); *Ngiriata* (Samburu); *Adeya, Har, Hardik* (Somali); *Eremonu, Colera, Loleo* (Turkana); *Haar* (Rendille).

This condition is characterized by frequent passing of loose faeces in suckling calves and can be caused by a wide variety of Bacteria *(Salmonella sp.)*; Parasites (*Coccidia*: especially species of Eimeria, Helminths- worms); Viruses (*Rota- and Coronavirus*).

Transmission:
- Through contaminated environment and direct contact from one scouring calf to the next; the more calves have diarrhoea the higher the contamination of the *Boma* and the higher the risk of new infections.

- Through contaminated water and feed.

Signs

- It is manifested as frequent passage of loose (watery, bloody, pasty, with pieces of mucosa, at times also smelly) faeces at the beginning.
- Little if any passage of faeces after some time but constant pressing;
- Soiled hind legs;
- sunken eyes (dehydration i.e. loss of fluid in the body, drying up of the body);
- Dullness, weakness; no appetite;
- Death due to dehydration or too little fluid left in the body. Sunk eyes and skin fold when raised does not slide back.
- Calves are dull and feels cold on the nose,
- Calf cannot stand up (calves with diarrhoea and that cannot stand may die). Three months old and below are particularly vulnerable especially during wet and rainy.

Prevention

- It is important to give calf colostrum during first 3-6 hours after birth.
- Move *Boma* frequently
- Do not over-crowd animals in one *Boma*.
- Separate sick calves from healthy ones.

Treatment

- Common treatment regardless of the cause of diarrhoea is replacing the lost fluid (rehydration). Start treatment when calf can still stand and suckle. Start rehydration early so that calf does not get weak.
- Mix 5 tablespoons of sugar and 1 tablespoon of salt with 2 litres of clean water (boil water and let it cool down before mixing). Instead of 5 tablespoons sugar, it is also very good to use 5 tablespoons of honey.
- A calf of 30kg needs a minimum of 3 litres per day (minimum 1 litre for 10 kg of body weight per day).
- Feed the rehydration fluid in small portions at the rate of one and a half cups' full at a time (equal to about 0.5litre).
- In addition, finely crushed charcoal (like powder) can be added to the rehydration fluid (2 handfuls of charcoal powder per litre, then passed through a sieve before giving it to the calf).
- Rehydration fluid should be given for 5 days.
- Milk may be withheld for first 24 hours but not for longer than 36 hours.
- From the second day on small amounts of milk can be given while still feeding rehydration fluid.
- Antibiotics are not required to treat diarrhoea but Sulphomamides given orally can be used.
- Calves that cannot stand up any more need both oral and intravenous rehydration therapy; for this, the services of a veterinarian will be required.

Trypanosomosis

Local Names: *Gandi* (Gabbra); *Dukan* (Somali); *Omar* (Rendille); *Saar* (Samburu); *Lotorobwo, lokipi* (Turkana).

This is a parasitic disease in the blood caused by different protozoan parasite -*Trypanosoma* species. *Trypanosoma evansi*, is mechanically transmitted by biting flies.

It is very common in all camel keeping regions. *T. congolense* and *T. vivax* occur only in and near tsetse fly infested areas.

Transmission

T. evansi is transmitted mechanically by bloodsucking flies (Tabanids),
T. congolense and *T. vivax* are transmitted by tsetse flies.
All ages of camels are affected however, it is uncommon in camels below one year of age.

Signs

Acute–

- Abortion, premature birth of weak calves;
- Edema on abdomen, on base of neck, or scrotum, on the legs up to the knees and the hocks, edema is very common with *T. congolense* infections.

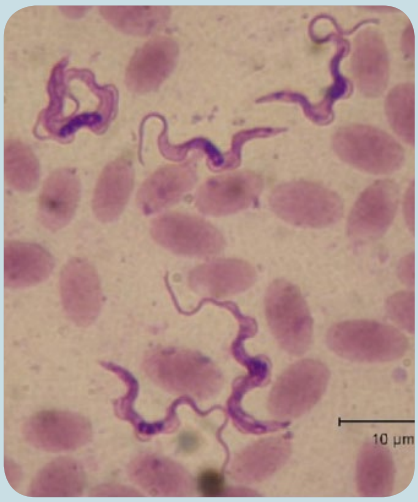
Chronic

- Abortion soon after infection before camel appears sick;
- Sudden drop in milk production;
- Chronic weight loss progressing over a long period;
- Pale mucous membranes;
- Flow of tears from the eyes;
- Camels appear "sleepy" –they sit down and rest while other camels are feeding;
- Dull coat; long hair at the tail coming off easily.
- Weak camels become susceptible to many other diseases (e.g., pneumonia).
- Urine has a characteristic smell.
- At post-mortem, camel often has a lot of water inside the abdomen.

Less common signs:

- The acute central nervous form caused by *T. evansi*.
- Brain affected, leading to dullness,
- Blindness (typical sign!) and
- Abnormal behaviour like crying and running around like a rabid animal.
- Death occurs after few weeks. The acute haemorrhagic form: Only in and near tsetse areas, caused by *T. congolense* and *T. vivax*.
- Acute form causing rapid death within a few days (esp. *T. vivax*).
- Dead camel shows internal bleeding and blood under the skin.

Camel suffering from T evansi



T evansi in blood

Note: Because camels migrate over long distances, infection with trypanosomes may take place in one location, but clinical signs may become visible in a different location.

The disease occurs any time of the year, but is more common during the wet season when the fly population is high and transmission occurs more frequently.

Treatment

Quinapyramine-salt and pro-salt (Triquin) preparation is available in a vial containing 2.5 g pale yellow/whitish powder. The drug is dissolved in 18ml of sterile water (provided). Under the skin injection at a dose of 0.03ml per kg live body weight. Triquin dosage is indicated below. Treat

sick camels as early as possible for high success rates. The drug is highly irritating and should not be used intravenously. It is very important to observe clean injection practices by using new disposable needles to avoid contamination that can lead to abscesses. Cymelarsan is prepared as a 0.5% solution in sterile water and administered at 0.25mg/kg live body weight by deep intramuscular injection into the neck muscles. The drug cannot be used for prophylaxis (protection) but only for curative treatment.

Rift Valley Fever

A viral disease transmitted by mosquitoes, common during excessive rainfall and flooding.

Signs

- Mass abortions in a herd (can reach almost 100%). Abortion occurs at any stage of pregnancy, and therefore aborted foetuses can be of different sizes.
- Sudden high death rate in new-borns (can reach almost 90%) immediately after being born and during first weeks of life.

Note: All ages are affected and occurs every 5 to 15 years after very heavy and prolonged rains associated with flooding and high mosquito population. There is no treatment as it is a viral disease

Prevention/Control:

Vaccination in Rivet Valley Fever prone areas as early as possible before outbreaks occur. Vaccine contains live virus and may cause abortion in pregnant camels; vaccination can only be done by competent veterinary personnel.

Note: Beside Rabies, this is the most dangerous disease that humans can contract from livestock in Africa! Affects and kills humans, especially those in close contact with animals (herders, butchers, veterinarians). No treatment is available for humans!

Mastitis

Local Names: *Qanyara* (Gabbra); *Canda-barar* (Somali); *Loebeta* (Turkana); *Nolkina* (Samburu); *Ugonjwa wa kiwele* (Swahili); *Giid* (Rendille).
Mastitis is the swelling of one or more quarters of the udder and secretion of abnormal milk.

Transmission

The main source of transmission is by the hands of the herder who milks an infected udder first and then a healthy one;

Adult lactating females and older camels are more susceptible to mastitis.

Signs

- One or more quarters of the udder are swollen, painful and hot;
- Reduced production or none at all;
- The milk can look and smell abnormal (yellow or brownish colour,
- Thick like pus or thin like water, may contain clots or blood).
- There can be difficulties in milking as teat canals are blocked.
- In severe cases, the camel may stop feeding,
- As the quarter remains hardened, does not return to normal and becomes a “dead quarter,” which no longer contains any gland tissue and cannot produce any more milk.
- Mild (“visible”) mastitis has the same signs as acute mastitis but changes in the milk and quarter do not last long and are less intensive.

Treatment

Swollen quarter should be milked frequently and calf should be allowed to suckle. It is also useful to cool hot swollen quarters and to massage them. Appropriate medicines e.g. Penicillin-Streptomycin or Sulphonamide injected at a double dose for minimum 3 days can cure fresh mastitis based on sensitivity results from a veterinary laboratory. Chronic mastitis cannot be cured.

Caution
Intra-mammary treatment (used sometimes in dairy cattle) is not recommended for camels because the camel teat has 2 to 3 fine openings. Each opening leads to a separate gland, so one quarter of the camel udder contains two to three separate glands.

Prevention/Control
Always milk young camels (especially 1 calving heifers) with clean udders first, even though they are often more difficult to milk than the older ones.

Brucellosis

Brucellosis kills humans if not treated. The risk is invisible because Brucella infected camels appear healthy and give normal milk.

To prevent Brucella infections in humans do not handle aborted foetus or placenta with bare hands and boil or pasteurize raw milk before drinking. Q-Fever also infect humans, transmission is similar to Brucellosis.

Notifiable disease: Yes. Whenever an abortion occur the foetus and other contaminated materials should either be buried deeply or burned

Section VI: Camel Products & Marketing

Camels, unlike other livestock species, can survive drought conditions and thus represent a climate adapted animal that can be a source of food and income to the pastoralists. Pastoralists rely on camel milk and meat as a source of protein and income. Increased production of safe camel milk and meat products will improve nutrition, human health, market access and incomes. Some hygienic management practices can reduce food contamination, hence reduce loss and improve health and income.

Current practices in camel milk and meat production by value chain actors present a rudimentary handling of these products and predispose them to contamination.

Camels have many products that are of commercial importance. They include;

- fresh milk and milk products like naturally fermented milk,
- meat,
- hump fat,
- hides and skins
- Other by-products (like camel feet [trotters] sold for soup kitchens).
- Camel blood,
- bones,
- bone marrow

Of all these products, the ones fully exploited at commercial level are Meat and Milk

Meat

Camel meat contributes about 20% of total meat consumed. Almost 66% of the national meat production goes through formal slaughter process, while the rest uses inform channels. Post-harvest losses can be as high as 50 per cent of the meat produced, which may cause food insecurity and reduced profit margins to value chain actors. Most of these losses are caused by inappropriate post-harvest handling, processing and preservation techniques.

Hygiene in handling camel meat

Good hygiene practices in food establishments are essential for consumer protection and the control of public health risks.

All workers in a food handling area are therefore expected to maintain a high degree of cleanliness of their body and clothing, and wear suitable, clean and, where necessary, protective clothing in order to ensure food safety and public health.

Most foodborne pathogens can survive on hands, mouth, skin, bruises, hair, sponges, clothes, and other surfaces for hours or days after the initial contact. In the pastoral environment, camel meat handlers lack experience and technical skills in hygienic handling of meat. Due to these factors, hygiene practices are generally low as seen in the photo below.

Noticeable unhygienic practices in the photo include;

- Environment of slaughter not suitable and not hygienic
- The meat handlers no suitable dressings to avoid cross contamination
- The positioning of the slaughtered camel does not allow proper drainage of blood
- The floor is splashed with blood and this attracts flies to the environment and contamination occurs
- The handlers are not properly dressed

Meat Preservation methods

Traditional methods

The main preservation techniques in pastoral/ nomadic regions of Africa are sun-drying and deep frying. These technologies have been associated with high microbial counts since the meat is exposed to the sun and also the drying rate takes long. Processing meat impart significant desirable changes on the quality attributes of meat and meat product. However, meat products development poses some technological challenges, mainly with regards to optimizing the formulation, processing, and subsequent storage.

Some of these methods include;

a) Nyirinyiri

It is an indigenous and ready to eat dehydrated meat product that is preserved in cooking oil. Camel *Nyirinyiri* is prepared by cutting boneless camel meat into thin strips then sun drying the meat for 1 hour. The sun dried meat is then comminuted into small cubes and deep fried in commercial vegetable oil. It is stored in the same oil and consumed little by little as required.

A: camel meat cut into strips and sun-dried in the open by hanging

B: The strips after sun-drying are comminuted into small cubes

C: The cubes are deep-fried in animal's own fat or vegetable oil

b). Others

Here is a mixture of other methods including;

- Sun-drying,
- Roasting
- Smoking
- Mincing in paste & motor

Handling Nyirinyiri at Production and Processing

Water activity (a_w) levels of *Nyirinyiri* ranges between 0.660 – 0.725. This value supports the growth of strains of molds such as *Apergillusflavus* and *Aspergillus parasiticus*. The minimum water activity at which molds are capable of growing is 0.61. Aflatoxins can be produced when the product is stored at a temperature of between 25°C – 30°C while exposed to oxygen. *Aspergillus flavus* produces the B type of aflatoxin which is the most potent while *Aspergillus parasiticus* produce both aflatoxin B and G. Aflatoxins are genotoxic carcinogens and are the most toxic of the mycotoxins. They have been linked to liver cancer particularly in developing countries where implicated foods are known to contain high levels of aflatoxins.

Nyirinyiri is marketed informally by the road side and inappropriately packaged in transparent polythene. These practices do not only predispose consumers to health risks such as food poisoning but also hasten spoilage of the meat by creating favourable conditions for microbial growth.

The challenges that impede women group *Nyirinyiri* processors which make them lose in quality, safety and price as well as accessing market opportunities include;

- The harsh climate and poor infrastructure
- Product variation in the degree of processing resulting in poor microbial stability
- Difficulty in achieving consistent quality
- Non-compliance to public health regulations,
- Inappropriate packaging, transportation and storage of the product.

Modern Methods & Value Additions

Camel meat handling and safety

Production of safe and wholesome meat, meat hygiene and fresh meat marketing is crucial. Meat hygiene rules must be strictly followed in order to produce safe and wholesome meat and meat products. This requires;

- A healthy and clean slaughter-stock,
- Hygienic slaughtering,
- Proper meat inspection and hygienic handling,
- Proper storage and transportation of the meat.

In the modern methods of handling meat, safety and wholesomeness is adhered to.

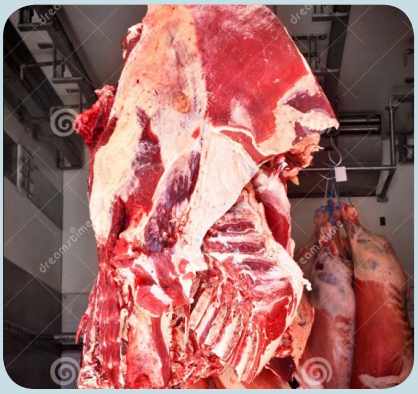
Make sure the camel for slaughter;

- Has no signs of disease or serious injury
- Is not be mistreated before slaughter
- If treated, not slaughtered before drug withdrawal period is over
- Make sure slaughtering is hygienic and use a slaughterhouse if accessible)
- Make sure water for washing is available
- Observe Halal slaughtering and humane killing
- Carcasses are suspended to allow sufficient drainage of blood before sell and/or storage.
- Meat gets contaminated and spoils rapidly therefore use cold storage where available.

The carcass is suspended to allow drainage of blood; the storage room should be cool and made of suitable materials

Transportation

Transportation should be by suitable standardized means like the recommended aluminium container or refrigerated container vehicles.



Modern methods of transportation of meat

Possible packaging using simple standard technologies at slaughter place in the Pastoral areas

Large fresh or frozen meat portions

The retail distribution of large fresh or frozen meat portions requires packaging that protects the product from contamination during the maturation, handling and transport, while extending the shelf-life of the product. This can be applied to fresh meats eg Bulk portions for distribution and portioned cuts for retail at local butcheries

Protection of the product for handling and transport

Large or bulk portions can be wrapped in food grade polythene for protection from contamination and transport

Small meat cuts/shreds/cubes
Small meat cuts/cubes like *Nyirinyiri* requires packaging that primarily protects the fragile product, while enhancing the colour and extending the shelf-life. It is important for the packaging designed to display the freshness of the product in a protective, informative, attractive package.

Smoked, cooked or dried meats
Prepared meat products require packaging that protects and holds the product in place, while enhancing product shelf-life. The packaging must retain the freshness of the product and display the product in an attractive pack presentation. This may include cured, smoked or salted meat.

Dried rolled meat

Sun-dried in protected environment

Cured meat
Some Recommended Food Grade containers for meat preservation

They could be food grade plastics or glass

Milk

The fat content mean for camel milk is 3.9 as compared to that of cow milk which is 3.3.

The solid non-fat percentage (SNF %) is 8.55 meaning more micro-nutrients including lactose and minerals.

Camel milk is also rich in Vitamin C which varies from 5-10mg %.
Camel milk is normally consumed as fresh milk or fermented milk

Fresh camel milk after milking in a traditional container

Value addition to camel milk value chain

- The current containers being used for milking and milk storage and transportation are non-food grade plastic jerry cans.
- The pastoral communities like them for convenience

Camel milk is consumed in the form of fermented milk. The milk is allowed to ferment naturally at ambient temperature in the jerry can until it turns sour. Due to the spontaneous nature of the fermentation, this traditional method results in a product with varying taste and flavour and is often of poor hygienic quality.

Milk receptacles that are recommended for milk storage and transportation

The Muzzy can and Aluminium can are easy to clean and sanitize
Hygienic transportation of camel milk from production areas to the aggregation centres.

Hides and Skins

Camel hides are important sources of foreign exchange earnings for Kenya and other African countries.

Full potential of camel hides has not been realized nor exploited in Kenya due to poor quality of hides which leads to low demand in both domestic and export markets

Traditional uses of camel hides

- To roof traditional houses of pastoral communities,
- making ropes, guards, drums, seats, sandals,
- praying mats and water and milk containers.
- Among the Turkana community, hide and skins are eaten as food, and also other communities use them as famine food.

Traditional treatments using salt

Wet salting method. Appropriate even in the pastoral areas

Debilitative effects of salinity observed on wet salting curing premises structures

Salted dried camel hides

Traditional products from camel hides

Value addition in curing hides resulting in fine camel products

Camel Leather hide tanned

Camel leather Safari jacket

Hygiene in Handling camel products

There are important factors to ensure when marketing camel products in order to ensure quality products and comply with the law.

- Herder shall maintain personal hygiene
- Shall be free from any zoonotic disease- cough, sneeze, open wound, diarrhoea
- Environment shall be clean from dust
- Food grade container approved for transportation
- Teats shall be free from wound, abscesses, swelling, ticks and mastitis
- Any improvements in the hygiene, processing, packaging and labelling of the products is called value addition and results in fetching higher prices and a bigger market

Live Camel Market

The price of camel in northern Kenya has increased 10 times in the last three years, following opening up of a camel export corridor in Ethiopia.

The average price of camel at the Moyale camel market is now US $ 1400 compared to US $140 three years ago. “Ethiopia has opened an export camel market for meat and a live animal mainly to the Middle East and this has helped farmers discover better prices. The market serves Kenya, Somalia, Ethiopia and Sudan traders. The main export markets for the camel meat are Egypt and the Gulf Cooperation Council countries of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates.

Camels at Moyale Market

The biggest camel market in Kenya is in Moyale, Kenya’s shared border town with Ethiopia. Its proximity to Ethiopia makes it easier for the Kenyan pastoralists to reach that market. Every weekday, an estimated 150 camels are sold at the Moyale market.

Marketing camel products

Camel products can be marketed by individuals or associations

Individual marketing: This is when you market your products yourself either in the market or rural setup. The advantage is that you are able to interact with customers directly and thus able to know their needs. The drawback is that this approach limits your sales to those who know or can access you.

Associations: These are groups of individuals who choose to market their products as a group. The benefits of group marketing is that they pool together their products and have a larger volume and are thus able to attract a bigger market. There are many women groups which are now successfully marketing camel milk or camel meat in many parts of Northern Kenya

Women market camel milk along the streets of Garissa

Anolei Women Milk collection centre, Isiolo Town

The Anolei women cooperative in Isiolo markets almost 8,000 litres per day of camel milk during the wet season to illustrate the power of associations. They have a refrigerated delivery truck that sells milk in Nairobi from Isiolo

Record Keeping in Business Enterprises

Records help an entrepreneur keep track of business transactions, aid in the filing of taxes, compile final accounts and act as a future reference. Record types include: Credit records, Debtors records, Production records, Cash book, Purchases records, Stock records and Assets records.

For small business owners everywhere, record keeping is a necessary and sometimes tricky part of making sure a business runs smoothly. Keeping clear records of income, expenses, employees, tax documents and accounts is good business.

Basic records include:

- Business expenses
- Sales records
- Accounts receivable
- Accounts payable
- Customer list
- Vendors
- Employee information
- Tax documents
- Invoices
- Purchase orders
- Receipts
- Banks statements
- Contracts

Keeping these records will help you:

- Know how much money to invest to create your product or service
- Set pricing
- Compare budgeted amounts to actual costs
- Track spending
- Make wise decisions about purchases
- Prepare for tax time
- Access customer and employee information easily
- Protect your business in the event of an audit or employee issue
- Calculate expected profit

To stay compliant and avoid legal trouble, it may be important to keep copies of all records even after they're not useful for day-to-day operations. For example, you may want to keep copies of all your contracts for up to seven years, but you should probably keep auditor reports, annual statements and retirement plan records indefinitely.

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