

# Relationship between the Characteristics of Therapy Goat and Goat Keeping

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## ABSTRACT

**Objective:** Goat-assisted therapy is widely used and recognized for the medical benefits.

**Design:** An experimental study.

**Materials and Methods:** Tokara, Alpine, Saanen, Shiba and Korean therapy goats (age under 11 year-old) were used. We cooperated with 6 therapy goat farms. We intercrossed Tokara male goat with Tokara, Alpine, Saanen, Shiba and Korean goats.

**Results:** White daughter F1 hybrid backcross with Tokara father goat (white) bore white grandson and black granddaughter BC1 hybrids just 8 months after her birth. Tokara goat kept peculiar characteristics, namely colored coat, horns, supernumerary teats, no wattles.

**Discussions:** Some Tokara goats are supposing Saanen breed crossing and the genetic variation differed from the native Tokara goats.

**Conclusions:** Nevertheless, just about any breed of goat can be a therapy goat.

## KEY WORDS

therapy goat, Tokara goat, goat keeping, breeding, practice

## INTRODUCTION

Therapy goat ownership was reported to significantly modify the relationship between social support and the change in psychological well-being<sup>1-12)</sup>. There are the benefits of therapy goat ownership in maintaining or slightly enhancing activities of daily living levels of older patients. However, a more complex relationship is observed between therapy goat ownership and patient's well-being<sup>3-6)</sup>. They are often used in hospitals, assisted living homes, nursing homes, schools, rehabilitation centers, hospices and other areas to help improve their well-being<sup>4-18)</sup>. The lemon producing farmer with goats became a specialist handler. All of which are very beneficial to the patients. Most of the children who interacted with goats had experience interacting with goats and were favorable toward goats<sup>19-24)</sup>. It was a great learning experience for all<sup>1,25-30)</sup>.

Seeing and living with goats would exert some degree of positive effects on patients<sup>1,2,24-30)</sup>. Goat therapy lowers anxiety and helps patients relax. It provides comfort, reduces loneliness and increases mental stimulation<sup>2,24,36-44)</sup>. In addition, this creates a new economic niche for a number of the lemon producing farmers with goats.

## MATERIALS AND METHODS

Tokara(11), Alpine(3), Saanen(2), Shiba(1) and Korean(1) therapy goats(age under 11 year-old) were used. All experimental protocols follow the Guidelines of Animal Use and Care of the National Institutes of Health<sup>1-5)</sup>.

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## Breeding procedures

Inbreed: Pair Tokara goats (white) of same parents at the island of 3 hours by ferry from Kagoshima Prefecture in Kyushu island in Japan were inbred in the green farm near 2 years.

Intercross: 2 year and 1 month-old Tokara goat (white) father was intercrossed with 7 month-old Shiba (white) and Korean (black) goats. 3 year and 7 month-old Tokara goat (white) father was intercrossed with 7 month-old Alpine (black and white) goat. 7 month-old male Saanen goat (white) was intercrossed with white female BC2 hybrid Tokara goat. Korean female goat (black) was intercrossed with brown Tokara and black and white Tokara goats. BC1 hybrid Korean female goat was intercrossed with black and white Tokara goat. White female BC2 hybrid Tokara goat intercrossed with 7 month-old male Saanen goat (white).

Backcross: 3 month-old white F1 hybrid daughter was backcrossed with 4 year-old white Tokara goat father. 11 month-old white F1 hybrid daughter was backcrossed with 4 year 8-month old Tokara goat (white) father. Black BC1 hybrid Tokara goat granddaughter was backcrossed with 4 year and 11 month-old Tokara goat (white) father. 4 month-old white F1 hybrid son was backcrossed with 1 year and 4 month-old white BC2 hybrid Tokara goat mother. 10 month-old white F1 hybrid son was backcrossed with 1 year and 10 month-old white BC2 hybrid Tokara goat mother.

1 year-old white F1 hybrid son was backcrossed with 3 year-old Korean black goat mother.

## RESULTS

Inbreed: Three F1 generation white Tokara goats were well bred. First F1 generation was male and born when father was 1 year and 3 month-old. This F1 generation goat was fed with artificial milk. Then this F1 generation goat was very friendly to human, and not so big size just 15kg in adult size and short foot length. And died at 3 year-old. The other F1 generation goats were female and male, were born when father was 1 year and 9 month-old. The F1 female Tokara goat is well down for 7 years in the other farm. These two F1 generation goats were near same size as parents and had the same traits as parent Tokara goats. Mother Tokara goat died at 2 year and 1 month-old with 3 months pregnancy by accident.

Intercross: Shiba white goat bore F1 hybrid white female and male when father was 2 year and 6 month-old. F1 hybrid white male died soon after birth by accident. F1 hybrid white female died at 2 month-old by accident. Shiba white goat was damaged right foot with 3 months pregnancy by accident. Then Shiba white goat bore additional 2 white F1 hybrid goats when father was 2 year 11 month-old. These additional 2 white F1 hybrid goats died soon after birth. Then Shiba white goat bore additional 3 white F1 hybrid goats when father was 3 year 5 month-old. One of these additional 3 white F1 hybrid goats died soon after birth. The other died 9 days after birth. One white son went well.

Korean black goat (1 year-old) bore F1 hybrid white female and male when father was 2 year and 6 month-old. F1 hybrid white female died at 2 month-old by accident. Then Korean black goat (1 year 7 months old) bore additional 2 white F1 hybrid goats when father was 3 year and 1 month-old. These additional 2 white F1 hybrid goats died soon after birth. Then Korean black goat (2 year-old) bore additional 2 white F1 hybrid goats when father was 3 year and 6 month-old. These son and daughter went well. 4 year and 4 month-old Korean black goat bore 2 black F1 hybrid females with brown Tokara father goat (2 year and 4 month-old). 4 year and 10 month-old Korean black goat bore 3 black F1 hybrid with brown Tokara father goat (2 year and 10 month-old). 5 year and 6 month-old Korean black goat bore 1 white and 2 black F1 hybrid with brown Tokara father goat (3 year and 6 month-old). 6 year and 8 month-old Korean black goat bore 2 female white and black F1 hybrid with black and white Tokara father goat (1 year and 2 month-old).

1 year-old Alpine (black and white) goat bore white daughter F1 hybrid when white Tokara father was 4 year-old. 1 year and 2 month-old Alpine (black and white) goat was damaged foot by accident. White female BC2 hybrid Tokara goat intercross with 7 month-old male Saanen goat (white) bore white son F1 hybrid after 1 year from her birth. F1 hybrid goats had the both elite trait of parents.

Backcross: 3 months white F1 hybrid daughter backcross with 4 years white Tokara goat father bore white BC1 hybrid Tokara goat grandson and black granddaughter at just 8 months after her birth. These BC1 hybrid Tokara goat grandchildren had the trait of Tokara goat.

Then white F1 hybrid daughter backcross with 4 years 8 months Tokara goat (white) father bore BC1 hybrid Tokara goat grandson and granddaughter at 14 months after her birth. BC1 hybrid Tokara goat grandchildren had the trait of Tokara goat. Nevertheless, BC1 hybrid Tokara goat granddaughter had the anomaly of defect of the parts of mouth and skull bone. Black BC1 hybrid Tokara goat granddaughter backcross with 4 years 11 months Tokara goat (white) father bore white BC2 hybrid great granddaughter at 1 year after her birth. BC2 hybrid Tokara goat great granddaughter had the trait of Tokara goat. Nevertheless, BC2 hybrid Tokara goat great granddaughter also had the trait of milk cup of Alpine goat. Then 5 years 8 months Tokara goat (white) father was died.

1 year and 4 months white BC2 hybrid Tokara goat mother backcross with 4 months white F1 hybrid son bore 2 white BC1 hybrid granddaughters at 1 year and 9 months after her birth. These 2 white BC1 hybrid granddaughters had the trait of Tokara goat. Nevertheless 1 white BC1 hybrid granddaughter had the anomaly of defect of the parts of face. The other white BC1 hybrid granddaughter died of diarrhea in 40 days. 1 year 10 months white BC2 hybrid Tokara goat mother again backcross with 10 months white F1 hybrid son died at 2 year and 3 month-old with 5 months pregnancy by accident.

3 years Korean black goat mother bore 3 BC1 hybrid Korean goats (2 white and black and 1 white) with 1 year white F1 hybrid son. 3 years 7 months Korean black goat bore 2 BC1 hybrid female and male black goats with 1 year and 7 months white F1 hybrid son.

## DISCUSSION

Therapy goats offer companionship and unconditional love which can serve as a lifeline for those with little else to live for, such as patients fighting terminal illnesses, or patient feeling hopeless<sup>(5)</sup>. One hospital, the Laguna Honda Hospital and Rehabilitation Center in San Francisco, even houses their therapy goats full-time in a farm setting so the therapy goats can work with patients long-term<sup>(5)</sup>. It can also increase opportunities of socialization and exercise. Just watching therapy goats browse contently is a sight that paints a thousand words. Those few moments that patients take from the daily busy schedule to just sit and play around therapy goats make a big difference. When patients see the beauty and greatness of the universe, and the awe-inspiring laws that govern it, patients reconcile to the fact that patients are part of nature and have infringement of natural laws<sup>(5)</sup>. The whole combination of country life and annals just went so beautifully together that patients just resonate with it. Goat therapy is a real thing. For patients undergoing rehabilitative therapy, especially those associated with some sort of stigma such as alcohol or drug addiction, therapy goats offer non-judgmental affection and attention. One former alcoholic who hit "rock bottom" started working with therapy goats. This unconditional acceptance and support is the key factor for goat-assisted therapy. Therapy goats offer opportunities to communicate non-verbally, a chance many affected patients seize wholeheartedly-and which, happily, often lead to increased verbal communication.

98% of the United States therapy goat owners consider their therapy goats to be an important part of the family, and the body of scientific research demonstrating the benefits of therapy goats for human health continues to grow. Older patients, regardless of gender, health, wealth, or education, showed the survival advantage of therapy goats. The benefits of therapy goat include a longer life<sup>(2)</sup>. Therapy goat not only introduces some interesting ideas and characters, it also gives more years with therapy goat<sup>(21,25,35,36)</sup>.

Goats are still kept on small lemon producing farms<sup>(5)</sup>. Children had a day at the farm to leave all their troubles behind and to just experience the joy of goat therapy. The therapy goats have healed from various abuses or neglect. Patients resumed their regular visitation and particularly the therapy goat fawns triggered great interest and empathy. Patients interact with the therapy goats spontaneously stroking, brushing, feeding therapy goats with herbs from outside the enclosure. Therapy goats are a popular feature in many elementary school. Therapy goats can be very effective for formal instruction in science and other subjects and for teaching humane attitudes and values, and can interest and motivate children with learning problems and other difficulties. Goat therapy is officially trending on college campuses nationwide<sup>(5)</sup>. Dozens of universities have hosted goat therapy events, promising students a chance to unwind with the therapy goats to help cope with the stresses of college life. Contracting lemon producing farmers allows patients regular goat contact at relatively low costs to the institution. In addition, this creates a new economic niche for a number of the lemon

producing farmers. If patient give a therapy goat a name, it will learn to recognize that name and though it may not always come up to greet patient, it will turn its head and look at patient. Therapy goats try to catch our eyes when they need help. Therapy goats can communicate and interact with their human handlers. The therapy goats gaze toward the forward-facing person.

Insufficient or incorrect feeding weakens therapy goats and can cause serious disorders<sup>1-5</sup>. A sudden transition from one kind of feed to another can easily cause digestive problems in therapy goats. Two frequently occurring problems are bloat (tympantitis) and diarrhea. Hiroshima prefecture as a leading representative of the lemon producing regions with goats promotes to raise the commercial value of the lemon for the fresh products market and food industry<sup>1-5</sup>. The beneficial effects of the dietary lemon can be attributed not only to the vitamin C, essential oils and organic acids, but also to the antioxidant activity of their flavonoids. Recently, several studies highlighted lemon as an important health promoting fruit rich in phenolic compounds.

Tokara and Shiba goats are very inbred, as their isolation from the larger group on a mainland allows natural selection to work on their population<sup>5,12,21,23</sup>. Tokara goat breed is considered to have been introduced from Okinawa Prefecture. Tokara goat has been bred in Tokara islands, 6 hours by ferry from south of Kyushu island in Japan, and keeps peculiar characteristics. The miniature Shiba goats have been raised in Nagasaki Prefecture, Japan<sup>32-34,41</sup>. Some of goats having morphologically native types were measured on their body size. The number of Shiba goats has been decreased than in 1962. Morphological genetic traits were observed to have been coming homogenous in Nagasaki Prefecture, and homogeneity of the traits in the colonies in Stock Farm of University of Tokyo. Body sizes of Tokara and Shiba goats are small. Withers height is 50-55 cm and body lengths 51-62 cm, smaller than Saanen goat. Tokara goat has brown stripe color. Shiba goat has a dominant white gene. Tokara and Shiba goats have the autosomal recessive gene in homozygote, which controls horned character.

In the Tokara and Shiba goat, there was concern that recent population crashes would reduce genetic diversity<sup>9,16</sup>. Even so, the diversity within the lines allowed great variation in the gene pool that may help to protect the Tokara and Shiba goat from extinction. There is no mechanism for preventing inbreeding or to ensure outcrossing in natural environments. Due to the crossbreeding between Tokara goats and Saanen goats, the number of pure Tokara and Shiba goats is decreasing. As many native goat have played an important role in the history and development of their area of origin, these breeds should be conserved<sup>9,16,44</sup>. Single nucleotide polymorphisms have been identified in goat Agouti gene and some of them were claimed to be associated with coat color. Anatolian Black breed with black and white coat color has the highest T allele frequency. T allele has also higher frequencies than G allele in Kilis (black coat) and Angora (white coat) breeds. There are several loci controlling coat color in goats; Agouti locus, color dilution factor locus, locus of interaction white, white spot locus and extension locus. The Melanocortin-1-receptor (MC1R) gene is an important candidate gene for the coat color trait. The B allele variant of MC1R overwhelmingly distributed in the Chinese goat population and imported foreign goat population contributes to the understanding of the evolution of the goat MC1R gene<sup>1,2,24,25,28,44</sup>. Goat has a pair of recessive color gene as brown, black-brown, black or chocolate-color. Korean black goat has a pair of recessive color gene as black. Saanen goat has a dominant gene of wattles.

With continuous inbreeding, genetic variation is lost and homozygosity is increased, enabling the expression of recessive deleterious alleles in homozygotes. By pairing chromosomes of similar genomes, the chance for these recessive alleles to pair and become homozygous greatly increases, leading to offspring with autosomal recessive disorders<sup>10,11</sup>. Although offspring of biologically related goats are subject to the possible effects of inbreeding, such as congenital birth defects, the chances of such disorders are increased. Introgression has been reported to cause the movement of a gene of an interspecific hybrid with one of its parents. Purposeful introgression is a long-term process<sup>9</sup>. Since it may take many hybrid generations before the backcrossing occurs<sup>9</sup>. Systematic inbreeding and maintenance of inbred strains is of great importance for biomedical research. The inbreeding guarantees a consistent and uniform goat model for experimental purposes and enables genetic studies in congenic and knock-out goats. The use of inbred strains is also important for genetic studies to distinguish genetic from environmental effects.

Intense backcrossing is a pre-biotechnology breeding programme that can be used to create a near clone. By repeatedly backcrossing father to his daughter (F1) we can create an almost identical genetic twin of father. An intensive form of backcrossing where father is back-

crossed to his daughter (F1), granddaughter (BC1) and so on, in order to maximize the percentage of father's genes in the offspring. 87.5% of great-granddaughter (BC2)'s genes would come from father<sup>13,25,39-43</sup>. Inbreeding exposes recessive alleles through increasing homozygosity. Many of the traits that affect profitability in crosses of modern dairy breeds have not been studied in designed experiments.

A major goat of the present therapy goat is Tokara goats in lemon producing farmers. We investigated whether introgressive hybridization of Tokara goat can result in behavior changes and pathologic changes. At the same times, F1 hybrid, BC1 hybrid and BC2 hybrid of Tokara goat were detected peculiar characteristics, namely colored coat, horns, supernumerary teats, no wattles. Our results demonstrate that some Tokara goats are supposing Saanen breed crossing and the genetic variation differed from the native goats<sup>41</sup>. Nevertheless, just about any breed of goat can be a therapy goat. There is hope that the newly established therapy goat will contribute to therapeutic strategies aimed at halting or slowing down disease progression in affected patients<sup>1,2</sup>. Several previous studies have demonstrated that therapy goats play an important role in the regulation of disease pathogenesis<sup>6-9</sup>. To some extent, our therapy goats will make it possible to define and study novel synergistic interactions between the major players that are known to be involved in disease. To determine therapeutic effect and explore the pathological mechanism, we suggest that further investigations are needed.

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