REDUCTION OF DIABETES MELLITUS IN CHILDREN
BY USING IONIZED WATER

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REDUCTION OF ENDOPARASITE INFECTION IN GOATS BY USING ORGANIC FEED

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TITLE

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ABSTRACT

*Haemonchus contortus* is a major helminth parasitic infection found in goat. Anthelmintic resistance has emerged due to increase usage of the same drugs on goats. Therefore, non-anthelminthic alternatives are needed to reduce endoparasite as well as decrease the spreading of anthelmintic resistance. Few studies showed that goats which took organic feed had lower egg count of endoparasite. This project was performed to determine the ability of organic feed to control the gastrointestinal parasites infection in local goats. The faecal egg count reduction test was done on 16 goats sample located in Kuching Division. The egg was then counted under 10x magnification and tabulated. Results indicated that significant reduction of fecal egg of endoparasite in more than half of the goats sample after six weeks taking organic feed. Those achieved expected results is due to content of organic feed such as sago pulp, alfalfa and palm seed oil. Endoparasitic egg identified were hookworm, coccidian and strongyloidies. However, genetic and environmental factors can also affect the results.
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CHAPTER 1: INTRODUCTION

1.1. Overview of study

Goat requires a good nutrient for good and profitable production. It is difficult to produce a satisfactory goat if there is no nutrition. Basically, nutrients needed by goats are energy (carbohydrate and fats), protein, vitamins, mineral and water (Gimenez, 1994). To date, there are a few studies on goat nutrition and infection compared to sheep (Van Houtert and Sykes, 1996). Compared to other nutrients, protein metabolism is the most commonly disturbed nutrient underlying the pathophysiology of nematode infection in ruminant (Bown et al., 1991). Some studies suggested that production of dairy goats can be increased by manipulating the protein nutrition intake. Besides, improvisation of the host immunity towards nematodes infection is portrayed and is able to control *Haemonchus contortus* and *Trichostrongylus colubriformis* (Hoste et al., 2005). Previous studies showed that high intake of protein in goat resulted in a greater weight gain and eventually grew faster (Ash and Norton, 1987). To maintain increased productivity of goat, it is essential to control those gastrointestinal nematodes, especially *H. contortus* and *T. colubriformis*. There are 2 types of *H. contortus* larvae, namely the goat-derived strain (GDS) and sheep-derived strain (SDS). The former seems to be cause more severe damage compared to sheep-derived strain. Goat-derived strain induced a great weight loss of goat besides decreasing the level of serum albumin and protein in goat. Apart from that, goats infected with GDS showed low levels of PCV, Hb and MCHC (Rahman and Collins, 1990).
Nevertheless, the nematodes had developed anthelmintic resistance. This creates a big trouble since they are resistant to benzimidazole, which is the main anthelmintic used among gastrointestinal nematodes in ruminants (Hoste et al., 2000). Anthelminthic resistance is a situation whereby the parasites cannot be reduced consistently with a normal dosage of the drug. Studies stated that most of the anthelmintic resistance of the parasite is due to the treatment frequency where large dose of anthelmintic was used against the same anthelminth family for years (Silvestre et al., 2002). In Malaysia, the emerging anthelmintic resistance problem was so obvious and showed that 33 out of 96 goat farms had developed resistance towards benzimidazole (Dorny et al., 1994). Another research had been done and stated that 10 goat farms in Penang were resistant towards levamisole (Chandrawathani et al., 1999). Several studies has shown that in order to reduce helminth infections either by biological or chemical method. *D. flagrans*, a nematode trapping fungus has its potential by trapping 55-98% of helminth larvae in fecal pallet (Terrill et al., 2004)

Usage of fecal egg count is the main method for many years to diagnose gastrointestinal nematodes infection in small ruminants. This method has shown that the prevalence and egg production of nematode can be estimated (Vercruysse, 1983). The organic feed we used constitutes of sago pulp, palm seed oil and alfalfa and this is considered as one way of organic farming. Studies showed that organic farming is able to create environmental safety that acts as a natural biological control for parasite by destroying the eggs and larvae of parasites (Ronchi and Nordon, 2003). Therefore, this project investigated the efficacy and potential benefits of organic feed in reducing the eggs of gastrointestinal nematodes.
1.2. Aims of study

**General Objective:**

To determine the ability of organic feed to control the gastrointestinal parasites infection in local small ruminants.

**Specific Objective:**

- To identify the common types of endoparasite found in goats.
- To identify the potential benefits of this organic food to ruminants.
- To identify the content of organic food that can against infection in ruminant.
CHAPTER 2 : LITERATURE REVIEW

2.1. Relationship between goat and nematode

The main causes of mortality and morbidity in small ruminants in Malaysia are helminth and respiratory infection. (Chandrawathani P. et al., 2002). Because of this infection, the worm control programmes has been heavily dependent on the use of anthelmintics which lead to severe drug resistance against the common strongyles such as *Haemonchus contortus*, *Trichostongylus* sp. and *Oesophagostomum* sp. (Chandrawathani et al. 1999). Small ruminants, such as goats, sheep, pigs and poultry are important for farmers (Douglas O. & Somkiat S., 2002). Eradication to Douglas G. and Somkiat S. (2002) presence of helminth parasites of all small ruminants are important for two reasons. First, their impact on health will reduces the level of output of meat, milk, traction and manure, and reduces their asset value though increased mortality, especially of young ruminants. Secondly, a sustainable approach to the control of gastrointestinal nematodes, which affect all species, has been to integrate many interventions involving feeding, breeding, grazing management and health control.

Nicholas J. (2002) found out that there are three animal husbandary systems in order to control parasite infections in ruminants. Firstly are the free range systems. This is a common system practised by smallholders whereby the sheep and goats are allowed to graze in the morning and are kept at night in simple shelters with little or no fencing. (Nicholas J., 2002). Secondly is the semi – intensive systems. Under this system, the animals are released during the day and housed at night. Supplementary feeding may be given when necessary. Proper sheds
with necessary facilities are provided to accommodate large flocks. Besides that, fencing is required for open pastures. Shepherds are needed to monitor the flock movement if integrated with crops such as coconuts, oil palm or rubber plantations. This type of animal husbandry practise is generally good as the flock is health can be monitored daily in the morning before releasing and in the evening when they return to the housing sheds. (Nicholas J., 2002). Lastly are the intensive systems. In this system, the animals are always kept indoors and stall-fed with concentrate feeds, fodder or other agricultural by products. They are provided with good housing facilities and require only minimum land size. However, this system is quite rare and it is not encouraged, but it can be recommended for a fattening project for lambs from birth till 3 months old to ensure good health care and better growth rate. (Nicholas J., 2002).

According to the Department of Livestock Development, the population of goats and sheep in Thailand are 125,000 and 75,000, respectively. Approximately 88% of the total population of goats is found in southern Thailand, particularly in five provinces close to the Thai-Malaysian border. In contrast to goats, the sheep population is scattered over other parts of the country. One of the likely constraints to goat and sheep productivity in Thailand is the effect of internal parasites on the mortality and growth of young animals and on the performance of adult animals. (Surasak K., Somkiat S., & Suropol C. 2002). Research studies on the prevalence of endoparasites in sheep in Thailand are very few. Only 4 publications have been located (Sukapasana, 1987; Chumnanpood et al., 1988; Sachit et al. 2002a, 2002b). Under grazing conditions on a research station, eggs in faeces of lambs of the following endoparasites were
found: *Strongyloides papillosus, Cooperia, Haemonchus, Oesophagostomum, Trichostrongylus* spp. and *Moniezia benedeni* (Sukapasana, 1987). Oocysts of coccidia were also found.

The role of hypobiosis in the epidemiology of gastrointestinal trichostrongyloid nematodes is well documented (Anderson et al., 1965; Gibbs, 1967; Connan, 1968; Armour, 1970; Eysker, 1980; Smeal and Donald, 1984; Eysker & Kooyman, 1993). According to a medical dictionary by Farlex, hypobiosis means arrested stage of development of nematode larvae in gut mucosa of the definitive host. In the temperate regions of the world, it has been shown that hypobiosis is the primary means of overwintering for *Haemonchus contortus* (Gibbs, 1967; Blitz & Gibbs, 1971a,b; Eysker, 1993). Because the infective stage of this nematode is highly susceptible to winter conditions (Kates, 1950; Crofton, 1963), the nematode survives the winter in the hypobiotic form and resumes development when climatic conditions become favourable for transmission (Anderson, 1972; Reid and Armour, 1972; Gibbs, 1973; Michel, 1974). It was initially thought that hypobiosis in *H. contortus* was solely induced by host resistance to worm infection (Michel, 1974; Waller and Thomas, 1975; Adams, 1983), but more recent studies have shown that environmental changes may play a more significant role (Eysker, 1981; Gibbs, 1986).

Studies of hypobiosis in *H. contortus* in the tropical and sub-tropical regions of the world are very limited and show variable results. For example, no hypobiosis was detected in Brazil (Charles, 1989) or Egypt (El-Azazy, 1990) whereas low levels of hypobiosis were observed in
Zimbabwe (Pandey, 1990; Pandey *et al.*, 1994.), South Africa (Boomker *et al.*, 1989; Horak *et al.*, 1991.), Nigeria (Chiejina *et al.*, 1988), Mauritania (Jacquiet *et al.*, 1995.), Saudi Arabia (El-Azazy, 1995.), and Malaysia (Ikeme *et al.*, 1987.). In contrast, high levels of hypobiosis were reported in Nigeria (Van Geldorp & Schillhorn van Veen, 1976; Ogunsusi & Eysker, 1979.). A survey of gastrointestinal parasites (GIP) of small ruminants in southeastern Nigeria had been done and showed that strongyliasis mainly *Haemonchus* spp. was the most prevalent GIP, followed by coccidia infection. This was done by Anene B.M. *et al.* (1994). The occurrence of the infection was influenced by host species, season, ecological zone, management system and age of the animals. Strongyloides followed by coccidia were the most prevalent infections. The prevalence of the other parasites, especially *Trichuris* and *Moniezia* was low. Mixed strongyle and coccidia infections were recorded in 168 (37.8%) and 35 (6.9%) of small ruminants examined in the wet and dry seasons, respectively. Mixed helminth infections occurred in 32 (7.2%) animals during wet and in 10 (2%) animals in the dry season. Concurrent *Strongyloides* infections were the most common, accounting for 84.4% and 60% of the mixed helminth infection in the wet and dry seasons, respectively (Anene B.M. *et al.*, 1994). The distribution of strongyle and coccidian infections is related to season, ecological zone, management system and age group. Annual prevalence of strongyle infection in goats was 62.2% (CI, 58.5-65.9%) and was significantly (P<0.01) different from sheep 47.4% (CI, 42-53.5%); coccidia infection was 32.8% (CI, 29.2-36.4%) for goats and 18.1% (CI, 13.7-22.6%) for sheep. Wet season prevalence of strongyle and coccidian infections was significantly (P < 0.01) higher than for the dry season. (Anene B.M. *et al.*, 1994)
Based on Baker R.L. et al. (1998), the use of faecal egg count as an ante-mortem means of diagnosing naturally-acquired gastrointestinal nematode infections of domestic livestock has been practised for many years. When egg and worm counts were categorised according to the concept of "low", "moderate" and "high", the association between them was found to be almost equally consistent in all age classes of sheep (McKenna, 1981). The major criticism of this method is the lack of information on the composition of infections, as the eggs of the various strongyle genera cannot be differentiated. Of the nematodes recorded in this survey two are likely to be of practical pathological importance. These are *H. contortus* and *O. columbianum*. *H. contortus* is prolific, has a relatively short generation interval and is therefore able to take rapid advantage of favourable environmental conditions (Grant, 1981). Heavy infestations (2000-3000 adult worms) are common in the rainy season. From January and onwards adults are rarely found (less than 5%). On the other hand, the prevalence of larvae in arrested development, essential for the survival of the species in the dry season, was 10% in April. In sheep, Schillhorn van Veen (1978) observed outbreaks in the late dry season (March--April) due to maturation of arrested *H. contortus* larvae, whenever the previous wet season extended to the end of October or beyond (rather than finishing at the beginning of October as in normal years). *Oesophagostomum columbianum* is also responsible for the high infestations in the late wet season. Larvae of this worm show a delayed development in the third to the fourth stage as they are encysted in nodules. About 70% of the older sheep at the Dakar slaughterhouse in April showed such nodules. At the end of the dry season, when resistance of the animals was at its lowest, the adults were in the intestinal lumen. Graber and Receveur (1956) estimated that the mortality caused by *Oesophagostomum* in Tchad exceeded 20%. The genus *Trichostrongylus* occurred primarily in regions with a temperate climate and did not thrive in the warm rainy season (Grant, 1981). The
cool season (January-May) is too dry (rainfall zero) to support development of the living stages. *Cooperia* spp. is mainly parasites of bovines and occur infrequently in ovines and caprines with a percentage of infestation below 15% (Vassiliades, 1981). *Strongylus papillosus* occurs in numbers below those causing any pathogenic significance even in lambs. *Gaigeria pachyscelis* is rare, 5-40% according to Vassiliades (1981), but more information about this parasite is necessary.

The adverse effects of endoparasites on productivity of animals are manifested in a variety of ways. Changes in body weight are the most common feature of infection. Reductions in liveweight gain vary with the level of infection, the species of parasites, and age of the animal, nutritional and immunological status of the host (Anderson, 1982). Gastrointestinal nematodes (particularly *H. contortus*) which inhabit the abomasum and suck blood from the host which can result in anaemia. The parasites also damage the abomasal mucosa in the stomach and causes plasma protein leakage. Anaemia and hypoproteinaemia are known to be the feature of *H. contortus* infection in goats (Rahman & Collins, 1990; Rahman & Collins, 1991). Blood constituents, particularly packed cell volume (PCV), haemoglobin and total serum protein are the major indicators of gastrointestinal nematodes infestation especially *H. contortus* (Rahman & Collins, 1990; Rahman & Collins, 1991). Change of these values from the normal values mainly depends on the severity of infestation. Four studies had been conducted to investigate the association between parasite infestation and blood constituents in goats in Thailand, one being under village management conditions (Kochapakdee et al., 1995b) and three under improved management (Pralomkarn et al., 1994; Pralomkarn et al., 1997; Choldumrongkul et al., 1997).
Based on Hoste, H et al. (2000), they found out that efficient control of gastrointestinal nematode trichostrongyle parasites is necessary to improve the productivity of grazing ruminants. However, this control is impaired by the spread of resistance to anthelmintics among the populations of worms. Anthelmintic resistance was first described for benzimidazoles in sheep in the southern hemisphere but it is now a worldwide phenomenon that concerns in all the different classes of anthelmintics available for use in domestic species (Sangster, 1999). Several surveys throughout the world have underlined the particularly high prevalence of anthelmintic resistance in trichostrongyles in goats. Improper use of anthelmintics in terms of timing, dose or choice has been related to the development of anthelmintic resistance. Conversely, a large amount of basic and applied research work has led to various programmes being set up to prevent or to limit the spread of resistance within the population of worms, particularly in Australia and New Zealand (Dash et al., 1985; Edwards et al., 1989).

2.2. Relationship between goat and nutrient

Justin McDaniel and Brian Freking (2002) stated that goat requires energy, protein, vitamins minerals, fiber and water. Energy is usually the most expensive. If there are any deficiencies, excesses, and imbalances of vitamins and minerals, this can limit animal performance and lead to various health problems. Fiber is necessary to maintain a healthy rumen environment and prevent digestive upsets. Water is the cheapest feed ingredient but it is the most neglected. (Justin M. & Brian F., 2002). Hay is the primary source of nutrients for goats during the winter or nongrazing season. Hay varies tremendously in quality, and the only way to know the nutritional content is to have the hay analyzed by a forage testing laboratory. Legume hays
such as alfalfa, clover, and lespedeza tend to be higher in protein, vitamins, and minerals, especially calcium, than grass hays. The energy, as well as the protein content of hay, depends on the maturity of the forage when it was harvested. Proper curing and storage is also necessary to maintain nutritional quality of hay. (Justin M. & Brian F., 2002).

Gimenez D. M. (1994), stated that, the essential minerals for sheep and goats are calcium, phosphorus, and salt. The primary sources of these minerals are the diet, various mineral supplements, and, in some areas, the water supply. Minerals are needed in only small amounts. Calcium is a necessary constituent of the bones and teeth and is essential for regular heart action and muscular activity. A calcium deficiency results in poor growth and bone development in growing animals. Phosphorus is an essential part of blood and of all cells in the body. It is involved in chemical reactions which release energy in the body. Bones and teeth contain relatively large amounts of phosphorus as well as calcium. Calcium and phosphorus are interrelated: while an adequate supply of each is required, they must also be present in the ration in the proper proportions. Vitamins are compounds which are necessary for normal growth, health, and reproduction. Small ruminants require many vitamins, just as other animals do. However, their dietary vitamin requirements are relatively simple because of the nature of the feeds they ordinarily consume and the synthesis of vitamins in the rumen. The many functions of water in the animal body include helping to digest food, regulating the body temperature, lubricating, and transporting waste from the body. To combine feed ingredients into the least costly but most efficient ration, producers must meet the nutritional requirements of each animal at its particular stage of life.
According to Justin McDaniel and Brian Freking (2002), in high-producing animals, feeding concentrates are often necessary to provide the nutrients in forage alone. Two types of concentrate feeds that can be used are energy feeds and protein feeds. Energy feeds are typically cereal grain such as corn, barley, wheat, oats, milo and rye. (Justin M. & Brian F., 2002). One of the problems with feeding a lot of cereal grains is that they are high in phosphorus content, but low in calcium. Feeding a diet that is high in phosphorus and low in calcium can cause urinary calculi or kidney stones. Proteins feeds contain in high levels of protein include soybean meal, cotton seed meal, meat and bone meal. Small ruminant do not store excess protein. So it is burned as energy or eliminated as nitrogen by the kidneys. Since parasites often cause blood loss in goat, higher levels of protein in the diet may enable the animal to mount a greater immune response to parasites. (Justin M. & Brian F., 2002). Goat requires many minerals. The most important minerals are salt, calcium and phosphorus. The ratio of calcium to phosphorus should be kept around 2:1 to prevent urinary calculi. Vitamins also are needed in small amounts. Small ruminants require vitamins A, D and E. Goats appear to have a much higher tolerance for copper in their diets compared to sheep, and therefore producers are recommended not to use feeds and/or premixes that contain copper if the goats are commingled with sheep. (Justin M. & Brian F., 2002). Goats should have ad libidum (free-choice) access to clean, fresh water at all times. A mature animal will consume between 3/4 to 1 1/2 gallons of water per day. Water requirements and intake increase greatly during late gestation and during lactation. Water requirements increase substantially when environmental temperatures rise above 70°F and decline with very cold environmental temperatures. Inadequate water intake can cause various health problems. In addition, water and feed intake are positively correlated, meaning that the more feed goats eat the more water that they need.