

Plants and Pills: Health Consequences of Western Medicine in the Peruvian Amazon

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Abstract

In 1999, a three-month study of indigenous ethnobotanical practices was undertaken in the upper Napo River region of Peru. In addition, annual health records collected provide data on illness episodes resulting in medical seeking behavior in 11 villages.

These data identify helminthic infection as an endemic condition in the region. The traditional anti-helminthic practice involves a preparation from the milky latex of the Ojé tree (*Ficus insipida*). The precision of preparation is important because of the harsh side-effects of over dosage. There has been a decline in the knowledge of this preparation over the past twenty years as Western medicine, introduced by local government health officials, has replaced traditional treatments. However, oftentimes health posts are not easily accessible and the availability of both the health providers and medicines (which require payment) are not ubiquitous. Although the national government campaign for "modern health care" in rural communities continues, the health promoters stationed in the villages are provided with minimal medical training. The reality is that there is a scarcity of medicines. The population is left dependent on a system of medical provision that can often offer no more than ibuprofen and iron supplements with an ideology focused on the inferiority of local healers' ability to provide medical care. The result is a decrease in future apprentices in local ethnomedical traditions.

One effect of this shift in medical tradition is reflected in the health of local children (birth to 14 years of age). Traditionally, children received regular medical treatment for helminthic infection approximately every 3-4 months; children now receive treatment only every 1-2 years. This pattern of care is inadequate for fighting helminthic infection due to the life cycle of the parasites. In addition, the health center data illustrate that with the rise in incidence of helminthic infection, childhood anemia and respiratory illness also increase. A cycle of disease magnification is in place.

The data document that the clash between traditional and modern medicine on the Río Napo is no merely intellectual: childhood health problems are escalating as the traditional practices are replaced by Western biomedical practices. Not only are the people of this region experiencing a decline in quality of health and wellness, but they are also rapidly losing vital ethnomedical information based on the local flora of this richly diverse ecosystem.

KEYWORDS: Peru, ethnomedicine, *Ficus insipida*, antihelminthic

1. Introduction

1.1 Modernization of Jungle Life

The flooded forests of the Peruvian Amazon are well known for their vast ecological diversity. Yet, little is known about the changing culture of the people that inhabit the region. The ribereños, or river people, of the NE Peruvian Amazon are representative of the common trend of globalization in developing regions of the

tropics. No longer able to identify with distinct ethnic or linguistic groups, the traditionally forest-dwelling peoples of the Río Napo have migrated to permanent villages positioned on the main river and its surrounding tributaries where they subsist through swidden "slash and burn" agriculture and net fishing. Primary food sources include *yucca* (manioc), maize, rice, plantains, fish, capybara, paca, and citrus

varieties. Villages are located directly along the river banks and huts are organized around a central field where soccer games and festivities occur. The population demographics demonstrate a concentration in school-age children with high mortality among infants and individuals older than 45 (Fig. 1). The average number of children per household ranges from 6 to 7. Many younger women are either involved, or have expressed interest, in the government family planning programs and hope to have a maximum of 2 to 3 children. Each community has a small government-established primary school that is taught in Spanish. Children are not familiar with the native language of their ethnic group.

Families live in palm-slat homes with thatch roofing. These huts are set on high stilts that protect the home from flooding during the high water season. Travel is accomplished primarily through the use of dugout canoes, although some villages have recently purchased a communal *peque-peque*,

or slow motor boat. Integration into a cash-market is apparent. Men commonly make a biannual trip to the city of Iquitos by river taxi where they sell monkeys, caiman, sloths, plantains, fish, chickens, ocelot hides, timber, and village-raised cattle in the Bélen market. The money acquired through these sales is used in the purchase of such items as salt, *aguardiente* (sugarcane rum), cigarettes, sandals, chainsaws, nylon fishing nets and hammocks, batteries, machetes, stereo systems, and second-hand Western clothes. However, this inclination for Western goods doesn't quite suite the rainforest ecology: the nylon fishing nets, old batteries, plastic bottles, and other non-degradable packaging materials are frequently dumped into the rivers after use. The concept of biodegradability is not generally understood as in the past all natural plant waste was safely disposed of in this manner. These problems of environmental pollution and misuse of forest products for acquisition of

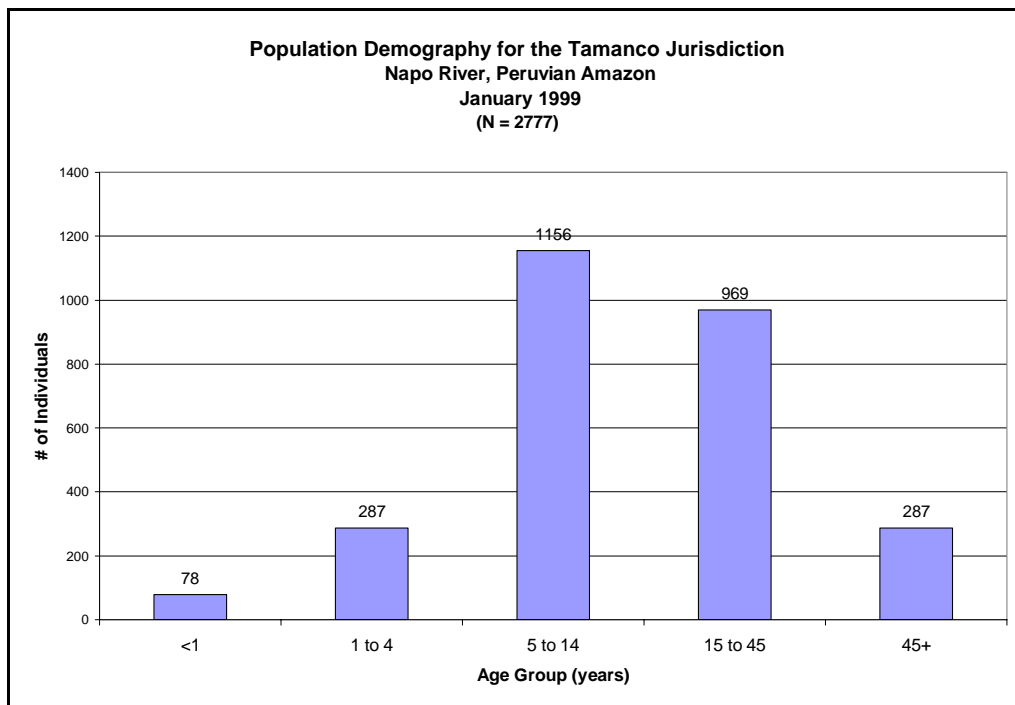


Figure 1. Population demographics (age distribution) for the Tamanco Jurisdiction in January 1999.

money and manufactured products represent just a portion of the overall dilemma facing this group.

1.2 *The State of Western Medicine*

Western medicine began its move into the upper Napo River region with the introduction of missionaries and rubber-barons as early as the mid-1800s. Today, the government influence on health is evident in villages. Well-intentioned programs to improve care were implemented by dividing rural regions into regulated Jurisdictions consisting of 11-15 communities. A primary health post was established at the center of each Jurisdiction and a small pharmacy or *botiquin*, which often consists of no more than a small medical box in the health distributor's hut, was established in each village. The main health posts are managed by a *sanitario* who has the medical training equivalent to a nurse. *Botiquin* health distributors are provided with very little training and are not always aware of the actual purpose or application of the pharmaceuticals stored in their medical boxes. Although the *sanitarios* are provided with more medical training, some major problems exist with their understanding of basic aseptic technique and disease theory. One example of this was the case of a 12 year-old boy that developed a severe, life-threatening infection after a *sanitario* sutured his dirty laceration without prior cleansing of the wound.

Acute health cases such as that demonstrated in this example are not, however, the prevalent health issue in the region. Chronic problems including severe anemia, respiratory ailments, and diarrhoeal disease present the most pressing health crises for the *ribereños*. Each of these problems can be easily linked to a pattern of frequent helminthic infection. An increased burden of intestinal helminthes is favored by sedentary housing patterns (cessation of village migration) and the resultant

accumulation of human waste, overcrowding, declining quality of diet, and water and sanitation problems. It is generally recognized that 90% or more of a village population is infected with at least one helminthic species. In fact, individuals are frequently infected by multiple species (Hansson 1986).

1.3. *Significance of Intestinal Helminthes as a Health Problem*

Chronic parasitic infection affects 3.6 billion people in developing countries, with children aged 5-14 comprising the most heavily affected group (WHO/CTD/SIP/96.1 1994). Helminthes such as *Ascaris lumbricoides* (roundworm), *Strongyloides stercoralis*, *Trichuris trichuria* (whipworm), *Enterobius vermicularis* (pinworm), *Ancylostoma duodenale* (hookworm), and *Necator americanus* (hookworm) are endemic in human populations of the rural, humid tropics (Banwell and Schad 1978). There are multiple ramifications to undiagnosed and untreated helminthic infections, from increased morbidity and mortality to poor growth and developmental delay. Chronic infection has been linked to anemia, immune compromise, malnutrition, growth retardation, cognitive deficits, and Vitamin A deficiency. General symptoms of acute infection include abdominal distension (in pediatric cases), abdominal pain, diarrhea, and pale skin (WHO/CTD/SIP/96.2 1996). Yet, surprisingly, the *ribereños* interviewed during this study do not generally recognize the link between the associated health problems and the actual parasitic infection.

Hookworms, which infect approximately 1.2 billion people worldwide, are closely associated with the development of anemia (Warren, Bundy et al. 1993). The development of iron-deficient anemia depends on the daily iron intake, iron stores, and the intensity and duration of

helminthic infection. Women and developing children comprise the group at greatest risk for developing anemia from hookworm infection because they usually have the lowest iron stores (Layrisse and Roche 1964). For example, a moderate hookworm infection can deplete 2.3 mg of iron per day. This approximately doubles the iron intake requirement of a menstruating woman (FAO/WHO 1988). Infantile hookworm infection in children <1 year-old is rare, but does occur. Reports from the World Health Organization state that *A. duodenale* can actually infect a fetus *in utero* via transplacental mechanisms. The mortality rate for infants born with hookworm infection is 4-12% due to intestinal hemorrhage or cardiac failure induced by severe anemia (WHO/CTD/SIP/96.1 1994). The transmission of hookworm is facilitated primarily through skin contact with contaminated soil. The extent of infection depends on three factors: concentration of fecal material in the soil, accessibility of a warm and humid environment for egg survival and larvae development, and the duration of contact with human skin. Hookworm eggs are transmitted in human feces where they can survive for a period of several days to a month. The eggs develop into infective larvae after a few days and can then enter the human host through the skin. After initial entry into the body, they migrate through the circulatory system to the lungs, pass through the alveolar system up the trachea, then are swallowed and deposited in the intestines where they can live for a period of 2-3 years (Banwell and Schad 1978). Hookworm infection leads to anemia through chronic intestinal blood loss. Adult hookworms attach to the lining of the small intestine, feeding on tissue and blood. The parasite changes its feeding site roughly every 4-6 hours, leaving behind sites for further blood loss from the damaged mucosal lining. Symptoms of early infection may include inflammatory diarrhea and

epigastric pain, commonly identified as *colico* in the region. Iron-deficient anemia may demonstrate such symptoms as hypoproteinemia, weakness, skin depigmentation (pale skin), and shortness of breath (Fauci, Braunwald et al. 1998).

2. Methods

2.1 The Study Population

The study population consisted of 2777 individuals distributed among the 11 communities of the Tamanco Health Jurisdiction (Figure 2). The jurisdiction *sanitario* and his daughter who served as a record keeper managed the main health post. There were six village *botiquins* (health stations) and four villages with a medicine cabinet in the health distributor's hut. All communities had very limited medicinal resources; one health distributor had nothing more than 3 iron supplement pills and a single condom in stock. Two *curanderos* (traditional healers) were located in the region. Contact with one of the two was extremely limited. Each reported treating <15 patients per month.

2.2 Field-Methods

Prior-informed consent was obtained and interviews with 4 groups of informants were conducted. Interviews were conducted with 68 heads of households (65 mothers and 3 fathers) in the Tamanco Health Jurisdiction (Loreto District, Peru). Data was collected over the span of two separate trips to the region: June-July of 1999 and December 1999-January of 2000. Semistructured interviews with heads of households were focused on parental perceptions of child health. Questions regarding illness episodes and health-seeking behavior in the family were reviewed.

The second group of interviews involved the 10 health distributors in the region. A list of stock medicines and other supplies

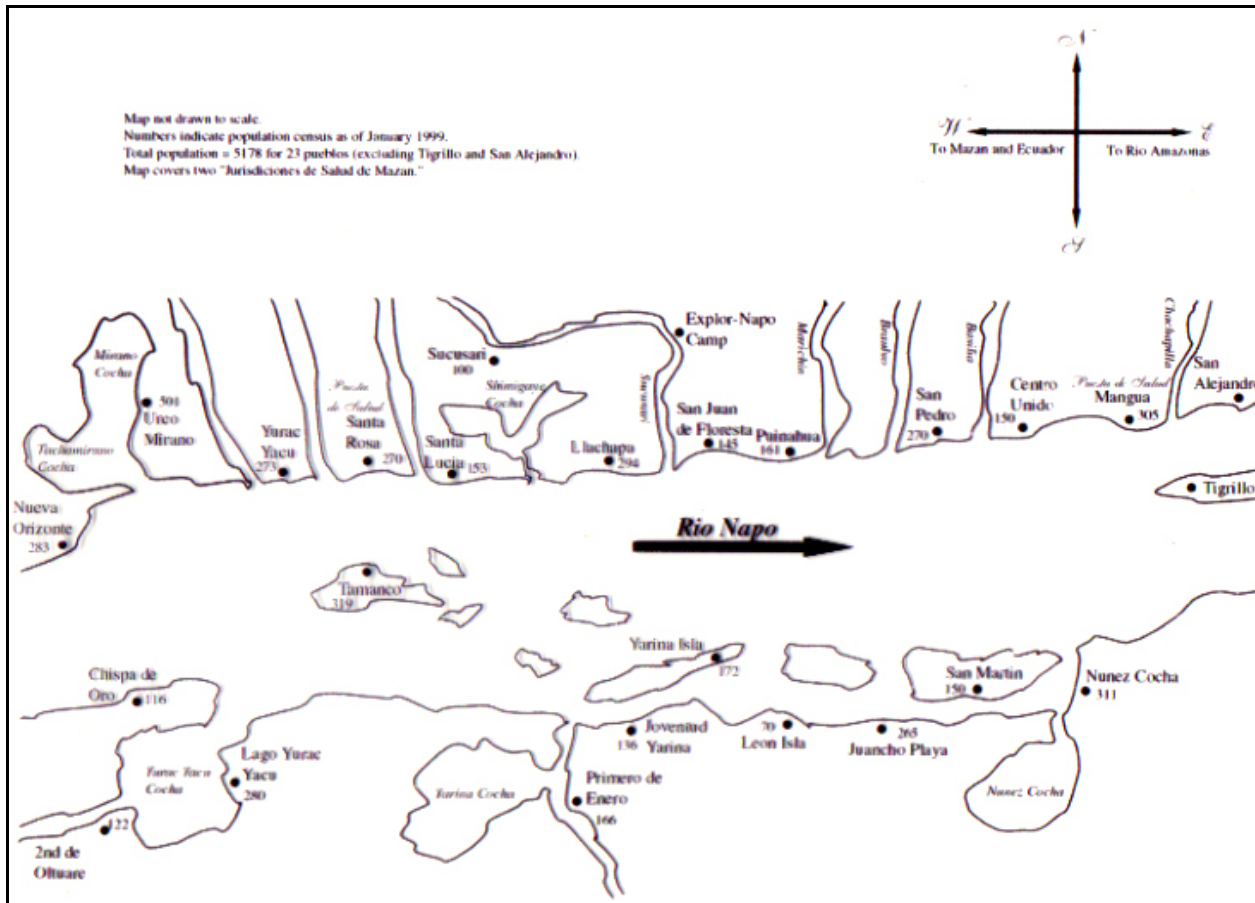


Figure 2. Map of the study location.

was made for each *botiquin* location. Records regarding the sale of medicines and history of cases treated at the clinic were documented. Semi-structured interviews were focused on the health distributor's general perception of village health. An assessment of general understanding of basic aseptic technique and application of medicines and supplies in stock was also made.

The third group interviews involved extensive daily interaction with a local Kokama *curandero*. Questions regarding illness episodes and health-seeking behavior in the region were reviewed. The uses and preparation of 97 medicinal plants was recorded and organized by local nomenclature. Detailed information regarding the local perception and treatment of intestinal helminthes was explored.

Preparation of the traditional remedy was verified through interviews with older individuals from different villages who had at one time used the remedy. Medical records for 6 months of medical cases treated at the main health post were provided by the Jurisdiction *sanitario*. Information provided in these records include the following categories: age, gender, community of residence, reason for visit, and treatment (pharmaceutical administered). Extensive interviews regarding illness episodes and medical seeking behavior were conducted with the *sanitario*.

3. Results

3.1 Local Perception of Disease

It is interesting to note that while *ribereños* treat anemia (pale skin) and

diarrhea with antihelmintics, they do not necessarily recognize the causal relationship between the parasite and associated illness. It is commonly believed that one is born with and harbors parasites in the body throughout life. It is not recognized that parasites are transmitted via contaminated soil. In the past, government health programs have been used to educate the people on the importance of boiling water before drinking it and many have subsequently made the link between raw water and parasitosis. Yet, while the link between the two is generally accepted, it is very uncommon for *ribereños* to actually purify their drinking water. This may be due to the belief that if one boils water “some of the time” then infection will not result. This translates to the boiling of family water maybe once a week at most. At all other times, it is taken directly from the river and drunk in raw form. Boiled water does not have the same “taste” or “flavor” that raw water has and is thus disliked for its unaesthetic qualities.

The occurrence of diarrhea and episodes of respiratory illness in childhood is common throughout the region. Such illness episodes are accepted as a common part of life and are not considered unusual or detrimental to

health unless acute symptoms are concurrently exhibited. In the past, a preventative regimen was prescribed for intestinal ailments and anemic symptoms. The regularity and precision of dosage of this regimen was considered most important for developing children. This involved the regular use of one of three primary plants every four months. These include “Ojé” *Ficus insipida* Willd. [Moraceae], “Papaya” *Carica papaya* L. [Caricaceae], and “Paico” *Chenopodium ambrosioides* L. [Chenopodiaceae]. Of these three, *F. insipida* is the most commonly used today and was thus selected as the focus of this study.

3.2 The Traditional Regimen: Ojé

F. insipida is a member of the Fig family, Moraceae. It is a tree that ranges from 12-40 meters and is locally identified by the copious white latex that is exuded from the trunk and stems upon cutting (Figure 3). Latex is collected in a jar the day before treatment. The recommended dosage (in spoonfuls) is combined and mixed with a glass of orange, cocona, or sugarcane juice. *Aguardiente* (sugarcane rum) may be used for adults. The mixture is taken orally early



Figure 3. Milky latex of *Ficus insipida* Willd.

in the morning, before sunrise. Fasting is required throughout the day. Plenty of boiled water should be drunk throughout the day to compensate for the loss of fluids with the resultant diarrhea. A light meal of plantains and manioc can be eaten that night, but all peppers, salt, alcohol and meat should be avoided for several days before and after treatment. The mixture should be taken for two consecutive days, once every four months to treat "pale skin" (anemia), diarrhea, and abdominal distension (in pediatric cases). Mothers are generally responsible for the maintenance of a regular treatment regimen for the family.

The active component of this latex is believed to be a proteolytic enzyme called ficin. This chemical requires activation by a reducing agent for maximum proteolytic activity and may explain the diet restrictions imposed during treatment. Ficin acts by destroying the helminth cuticle and altering its muscle cells, resulting in general maceration of the parasite (Hansson 1986). Ficin exhibits a low level of toxicity to humans and is not absorbed well across the intestinal tract (Hansson 1986). The accuracy of dosage is vital: if one receives too high a dose, then intense and painful abdominal cramping may ensue.

The treatment is viewed as effective when a visible reduction in abdominal distension can be noted (in children) and when anemic symptoms (pale skin and general fatigue) are relieved. The treatment should be repeated every four months as this is the approximate time that it takes for a heavy parasite load to become reestablished in the body. This cycle is due to frequent reinfection by infective larvae found in the soil and water in the region.

3.3 The Modern Regimen: Mebendazole

Mebendazole is a member of the benzimidazole drug class. It is taken as a 500 mg pill for the treatment of intestinal parasitosis. Mebendazole is a broad-

spectrum drug that is effective against a majority of helminthes. It acts as a microtubule poison, binding tubulin in the parasite and impairing physiological function. The parasites are expelled with bowel movements following treatment. Mebendazole exhibits a low level of absorption and toxicity and is rapidly processed by the liver. One limitation of the drug is that it is not very effective against hookworm when taken in a single dose (WHO/CTD/SIP/96.1 1994).

The cost of mebendazole in the region is 2 solas (\$0.66) per pill. For an average family of two parents and six children, a single yearly treatment is costly (16 solas=\$5.28) in comparison to a typical annual income. If the treatment is taken regularly, every four months as prescribed to keep the parasite load to a minimum, a family would have to spend 48 solas (\$15.84) a year. Considering that integration into a cash-market economy is limited and that families can afford to travel to trade small goods in the city only twice a year, the regularity of treatment is understandably very low. Instead, families reliant on this new system of Western medical care receive treatment only once every one or two years – or when acute illness develops.

The cost of the Western pharmaceutical regimen is only one of the barriers facing individuals in the region. The actual availability of the medicine is also very limited. If the individual seeking treatment lives in a village far from the central health post, as most do, and the medicine is not available in the village *botiquin*, treatment is normally not received. A disturbing point to note is that many of the village *botiquins* had no more than a few aspirin, iron-supplements, and some expired antibiotics. In the face of malaria outbreak in the summer, one village health promoter was helpless to provide care to his small community. This outbreak resulted in the

death of three individuals in this community of 100 people.

3.4 Health Seeking Behavior in the Face of Parasitosis

The results of the interviews conducted reveal that while 95% of parents are aware of the use of Ojé and had in fact received it themselves as children, only 17.6% knew the correct preparation and dosage. Only 5.8% of parents who knew how to use the plant cited regular application of the latex for this purpose. There is a general sense of fear regarding incorrect dosage – most parents do not trust their knowledge of the regimen enough to give it to their children. Children also expressed a dislike of the treatment because of the unpleasant taste of the latex and the intense diarrhea that follows.

The supply of in-stock medicines and training of local health promoters is generally low in the villages studied. It is not uncommon to find expired medicines. The use of protective latex gloves in the treatment of lacerations and infected wounds is highly uncommon. The cost of medicines is generally above the means for purchase. It is not unusual for health promoters to waive the fee for a medicine among family members and close friends who are in need of treatment. This has also contributed to the general decline in supplies at the *botiquins* as funds from medicines sold are supposed to be used in the purchase of new medicines from Iquitos. During a period of community health crisis (the malaria outbreak of July), three of the more isolated communities made a group effort to purchase the necessary medicines through the sale of village cattle.

4. Discussion

The relationship between hookworm parasitosis and iron-deficient anemia has been well documented by case studies in areas such as Kenya, Sri Lanka, India, and Venezuela

(WHO/CTD/SIP/96.1 1994; Oberhelman, Guerrero et al. 1998; UNICEF 1998). In this evaluation of the public health condition of the Tamanco Jurisdiction in Peru, I found a high prevalence of both endemic helminthiasis and anemia in the pediatric population. In addition to this, chronic health problems such as respiratory ailments, throat infections, and dermatitis were common. Yet, as in any study of associations between potential disease risk factors, mere association does not indicate a causal link, and it is likely that many developmental delays in children from developing countries are multifactorial. The cross-sectional study design does not allow for the analysis of the temporal sequence of parasitosis, anemia, developmental delays, and those diseases subsequent to a state of immune compromise. A longitudinal, cohort study would be necessary to provide this crucial piece of evidence.

Many of the problems that contribute to this high frequency of hookworm transmission in the Tamanco district are due to social factors that have developed as a result of Western influence in the area. In the past, medicinal plants were used and obtained from local *curanderos* in the region. Plants such as Ojé (*F. insipida*) were readily available in each village for the treatment of intestinal parasitosis. This mode of medical provision was beneficial in that people had easy, predominantly cost-free access to medical care near the home. Thus, with higher frequency of treatment, the parasite load in children was kept low and this effectively prevented the development of extreme cases of iron-deficient anemia.

When the Peruvian government took action to “modernize” the system of medical provision in the rural areas of the country, a stigmatic sense of inferiority was also placed on the local *curanderos*. In the early stages of this medical initiative, village clinics were well stocked with supplies and medicines. Yet, as time has passed, supplies

have become depleted. During this period of transition, the once respected *curanderos* were unable to find apprentices to pass on their extensive knowledge of the local medicinal flora. With time, these natural pharmacists and health providers have died and centuries of knowledge have gone with them. Thus, the well-intentioned initiative to bring “modern” medical care to rural communities has actually resulted in a decline in community health. It has led thousands in this region alone to dependency on a system of medical provision that is severely lacking in both medical supplies and trained health providers.

4.1 Risk Factors

Before discussing actions taken to manage the problem of recurrent helminthes infection, some risk factors should be identified. Aside from hookworms, most intestinal parasites are transmitted through oral ingestion of contaminated water or food. In the *varzea*, or flooded forests of the Amazon, seasonal flooding plays a major role in environmental and health ecology. Clean well water is not available and the flooding of the late spring releases all fecal material held in latrines into the water surrounding the stilt-perched village huts. Previous efforts have been made by government health officials in the region to educate the people on the importance of boiling water before consumption. While the majority of women who are in charge of household food preparation are aware that water should be boiled or chlorinated before consumption, it is rare for them to actually do so. Reasons for not purifying the water include a general strong dislike for the taste of treated water and the inconvenience of the process.

Just as purified water is not generally provided in the home, it is also not provided at school. During recess, elementary school children play games of soccer and drink from a bucket of raw water drawn directly from

the river by the teacher. School-aged children (5-14 years-old) comprise the group at greatest risk for a heavy parasite load (WHO/CTD/SIP/96.1 1994). In addition to drinking unpurified water at school, children are often malnourished and are not provided with a midday lunch by either their home or school. Another risk factor for this particular group involves play behavior. The common lack of shoes or sandals combined with frequent contact with contaminated soil in the village center (which is frequented by farm animals such as cattle, pigs, and chickens) at school recess and in the late afternoon enhances the probability of helminthic transmission.

5. Conclusion

5.1 Goals in Global Infection Control and Management

The eradication of hookworm infection is a long-term goal for countries and regions where the parasite is endemic. However, past community efforts to permanently rid hookworm from the area have failed due to frequent reinfection. These past failures have contributed to a decline in funding and support for eradication programs in the past 20 years (Mascie-Taylor, Alam et al. 1999).

More recently, the programmatic focus has shifted from eradication to control. Due to the intensity-dependent relationship between iron-deficiency anemia and parasite load, a reduction in the intensity of infection alone will help control the development of anemia and other disorders resultant to this problem. Current control efforts are now focused on reducing infection load and transmission potential in an effort to reduce morbidity associated with the disease (Giles 1985). Such efforts employ a combination of antihelmintic drug therapy and education programs for safe sanitation management.

The most commonly used antihelmintic drugs for these control efforts are the

benzimidazoles (albenzadole and mebendazole) that cover a broad-spectrum of helminthes and can reduce prevalence and intensity of hookworm with >90% effectiveness (Fauci, Braunwald et al. 1998). Studies with Kenyan preschool children have shown that treatment with antihelmintic drugs is associated with measurable improvements in physical growth and fitness (Stephenson, Latham et al. 1989). In addition to chemotherapeutic management, sanitation programs provide latrines along with education programs for use of the facilities and treatment of human waste prior to agricultural use as fertilizer. The use of footwear is also promoted through these programs and can reduce the intensity of infection by decreasing the frequency and duration of skin contact with contaminated soil.

5.2 Recommendations for Local Helminthes Control

As with other globally implemented programs for helminthes control and management, a multifaceted system of education, chemotherapy, and iron supplementation is necessary. Behavioral changes must be made in order to make a significant difference in the frequency of transmission. Such health-promoting behaviors would include the use of safe human waste disposal systems, purification of all water ingested by either boiling or chlorination, and the use of protective footwear. Unfortunately, these changes will most likely not be made with ease. Approximately 90% of the mothers interviewed were aware of the risks associated with providing raw, unpurified water for consumption to their families. While all initially claimed to purify their water, further questioning revealed that they do so “some of the time”, stating that the purification process is inconvenient and changes the “flavor” of the water.

In addition to these changes in

health-related behavior, a scheduled whole community treatment is recommended every four months. This could be accomplished through teaming local health providers with local *curanderos* to facilitate educating the community on the proper dosage and preparation of the *F. insipida* latex. This would enable treatment of a large proportion of the population who could not otherwise afford treatment or make the long trip to the central health clinic. In addition to this group treatment, ferrous sulfate should be placed in stock in the local *botiquins* to assist in the maintenance of sufficient iron level specifically in women and children with low-intensity helminthiasis. In conclusion, though hookworm and other various helminthes are the cause of many diseases, including anemia, they present a manageable problem that can be effectively controlled with the aid of some simple, integrative, culture-specific programmatic measures.

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