

Laura Calvet Mir

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THE DIVIDE BETWEEN LOCAL MEDICINAL KNOWLEDGE AND
WESTERN MEDICINE. A CASE STUDY AMONG THE TSIMANE', IN
THE BOLIVIAN AMAZON

AUTHOR NAME: Laura Calvet Mir

ADDRESS CORRESPONDENCE TO:

Laura Calvet Mir

Institut de Ciència i Tecnologia Ambientals

Universitat Autònoma de Barcelona

08193 Bellaterra, Barcelona, Spain

Tel: +34 (93) 581 42 18

Fax: +34 (93) 581 33 31

E-mail: laura.calvet@campus.uab.cat

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ABSTRACT

Interest in Local Ecological Knowledge (LEK) has grown in the last decades with much research focusing on how LEK can contribute to manage complex systems. Researchers have underlined that merging the two different epistemologies that represent LEK and Western science has the potential to create local institutions to improve public health, promote biocultural conservation, and help the population to have medical sovereignty. In this article I focus on local medicinal knowledge within a native Amazonian population, the Tsimane'. The article has two goals. First, I assess whether Tsimane' integrate conceptually and practically the plants and pharmaceutical treatments for gastrointestinal diseases. Second, I analyze if practitioners of the two medical systems show willingness to cooperate among them under the assumption that such cooperation can contribute to improve indigenous people's health. I found that Tsimane' do not include pharmaceutical treatments in their cultural domain of medical treatments, but they combine ethnomedical and biomedical treatments at the practical level. Results from a participatory workshop show that ethnomedicine and biomedicine practitioners express willingness to cooperate and promote synergy between both health systems. Both in theoretical and local arenas, researchers and the public emphasize the divide between local medical practitioners and Western doctors. Those negative perceptions can taint cooperation between both health systems, despite current eclectic practices by indigenous populations and expressed willingness to cooperate.

AUTHOR'S STATEMENT

Laura Calvet Mir

Institut de Ciència i Tecnologia Ambientals

Universitat Autònoma de Barcelona

08193 Bellaterra, Barcelona, Spain

Tel: +34 (93) 581 42 18

Fax: +34 (93) 581 33 31

E-mail: laura.calvet@campus.uab.cat

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1. INTRODUCTION

In recent years researchers and policy makers have shown a growing interest in the knowledge hold by indigenous and rural peoples (Posey 2000; WCED 1987) with the common understanding that indigenous knowledge holds the potential to inform conservation and development projects (Laird 2002; Warren et al. 1989). Researchers and policy-makers usually conceptualize indigenous people's knowledge as a particular form of knowledge separated from Western science (Berkes,F. and Folke, C. 1998; Berkes and Folke 1992/3; Gadgil and Berkes,F. and Folke, C. 1993; Hobart; Hunn 1993; Lyotard 1979; Toledo 2002). But whether indigenous people themselves conceptualize indigenous and Western knowledge as separated forms of knowledge or not is an open question.

In this paper I study how the Tsimane', a native Amazonian population, conceptualize and use indigenous and Western forms of medicinal knowledge. Specifically, (1) I assess whether the Tsimane' integrate or dissociate local and Western medicine, both conceptually and practically, and (2) I assess whether practitioners of both medical systems show willingness to cooperate in combining both types of systems. For reasons I will discuss later, I use the term local medicinal knowledge to refer to the cumulative body of knowledge of medicinal plants and healing practices particular to a culture that have been handed down through generations and adapted into a particular place. By healing practices I mean both the local system of health beliefs and the treatment options available to treat recognized illnesses. I use ethnomedicine

as synonymous of local medicinal knowledge. I use the terms local practitioners to refer to traditional healers (people who practice local medicinal knowledge) and health assistants (villagers trained to voluntarily oversee villager's health). Traditional healer is the best word I have found in English to refer to "*cocotsi*" or "*curandero*", the words used by the Tsimane'. I use the term biomedicine to refer to allopathic or Western medicine, and the terms doctor or biomedical practitioners to refer to people who practice allopathic medicine.

From the many domains of indigenous knowledge, in this article I focus on local medicinal knowledge because local medicinal knowledge is i) widespread through the world, ii) politically and economically important for policy makers, and iii) socially important for the health of indigenous people. First, around 70 to 80 percent of the population in the developing world depends on medicinal plants for primary health care (Gogtay et al. 2002; Kabuye, C.S. and Ngugi, G.W. 2002; Pearn 2005). By focusing in a domain of knowledge that is so widespread, the results of this research might be of interest to many different populations. Second, in recent years the state sector and non-governmental organizations in many countries have moved from the denial towards the acceptance of the utility of local medicinal knowledge (Ellen, Roy and Harris, Holly 2000). Policy-makers recognize the economic and political potential of local medicinal knowledge. Third, local medicinal knowledge has demonstrated to be culturally appropriate, holistic, and tailored to meet the needs and expectations of the patients in different parts of the

world (e.g. Abubakar et al. 2007; Elvin-Lewis et al.; Pearn 2005).

Furthermore, local medical knowledge persist long after the local use of flora as sources of food, weaponry, totemic identity, and religious rites have disappeared (Pearn 2005). So, indigenous and rural people are likely to continue relying on local medicinal knowledge for the next decades.

This research is important for at least four different reasons. First the relation between Western science and other types of knowledge is at the core of the debate on how merging multiple epistemologies can contribute to development (Berkes,F. and Folke, C. 1998). In this article I assess whether practitioners of two medical systems show willingness to cooperate under the assumption that such cooperation can contribute to improve indigenous people's health. Second, previous research suggests that local medicinal knowledge is culturally appropriate (Pearn 2005), but the recent availability of Western medicines in developing countries often disrupts local health practices and beliefs (Good 1994). This seems to be the case among the Tsimane'. According to Byron (2003) and Tanner (2005) the absence of communication between practitioners of the two health systems translates in a Tsimane' misunderstanding of Western treatments. Lack of understanding of biomedicine leads to misuse of drugs with potential negative effects on Tsimane' health. By analyzing and promoting the communication between both health systems, the work presented here could help limit the negative effects that the Western medical system can have in the local medical practices and beliefs and in indigenous peoples health. Third, previous research has

pointed out the positive view that traditional healers have towards biomedicine and their motivation to cooperate with doctors (e.g. Abubakar et al. 2007; Gogtay et al. 2002; Miraldi et al. 2001/5; Schillhorn van Veen 1997/7/31; Vanderbroek et al. 2004). These studies reflect the potential complementary between both bodies of knowledge, and underline how the combination of both medical systems can help to improve indigenous people's health. The cooperation between both systems can be seen as adaptative co-management (Moller et al. 2004), in which health management can be shared between local communities and institutions. The cooperation between both health systems would integrate local medicinal knowledge and Western medicine exploring the connections between the entire repertory of symbols, concepts and perceptions on health, and the set of practical operations taken by people. This approach has been useful in lots of works in natural resources and development (Agrawal 1995; Berkes,F. and Folke, C. 1998; Toledo 2002). Furthermore, research in Bolivia (Vanderbroek et al. 2004), Nigeria (Abubakar et al. 2007) and Iran (Miraldi et al. 2001) shows that the cooperation between ethnomedicine and biomedicine is possible and might benefit the local population and the natural environment. This article contributes to this growing body of literature. Last, local medicinal knowledge has proven to be an important tool to improve people's health (McDade et al. 2007; Reyes-García et al. 2008), incorporate value to the local practices and beliefs, engage local people as a part of a team, promote local biological and cultural diversity, limit the dependence on imported medicines, and encourage

national potentialities (e.g. Brennan 2002; Miraldi et al. 2001/5; Pieroni et al. 2004/12; Schillhorn van Veen 1997/7/31). Promoting cooperation between both medical systems could help strengthen local medicinal knowledge and its beneficial attributes to local populations.

The article has seven sections after this introduction. On the next section, I review current debates surrounding the divide between Western science and other epistemologies and define the working concepts that I use in the article. On the third section, I provide an ethnographic description of the Tsimane' focusing on their medical system. On the fourth section, I present the methods used in this research. On the fifth section, I present the results that allow me to assess whether the Tsimane' integrate or dissociate local and Western medicine, both conceptually and practically. On the sixth section, I present results from a workshop where I tried to assess whether practitioners of both medical systems are willing to cooperate in combining both types of medicine. On the seventh section I discuss the main substantive findings of the research. The concluding section underlines how local medicinal knowledge might be useful to strengthen medical sovereignty at the local level and promote biocultural conservation.

2.THEORETICAL FRAMEWORK

The last two decades have witnessed a growing interest in indigenous, traditional, or local ecological knowledge (e.g. Berkes et al. 2001; Drew, J. A. and Henne A. P. 2006; Gilchrist and Mallory, M. and Merkel, F. 2005; Moller

et al. 2004). This interest is reflected both in a large number of studies on the topic and the introduction of traditional ecological knowledge in international conventions. For instance, the World Commission of Environment and Development has stated that tribal and indigenous peoples' lifestyles can offer many lessons to modern societies in managing in sustainable ways complex ecological systems (WCED 1987). The same document states that the disappearance of the knowledge associated to those lifestyles is a loss for the humanity. Other international conventions such as the Convention on Biological Diversity (1992) and the Draft declaration on the Rights of Indigenous people (1993) had also recognized the inextricable link between biological and cultural diversity and the role of indigenous knowledge on *in situ* biodiversity conservation.

Despite the awareness of the importance of non-Western knowledge, researchers still lack an agreement on the definition and term to be use to refer to this widespread form of knowledge. Authors have used several terms to refer to the local knowledge hold by indigenous and rural populations. For example, Ellen (1982) and Posey (2000) have used the term Indigenous Knowledge (IK), Merculieff (2002) has used the term Traditional Knowledge, Gadgil and colleagues (1993) have used the term Traditional Ecological Knowledge (TEK), Gilchrist et al. (2005) have used Local Ecological Knowledge (LEK), Ellen and Harris (2000), and Toledo (2002) have used Indigenous Environmental Knowledge, and López et al. (1997) have used the term Folk Knowledge. In using this variety of terms, authors have sometimes

referred to the same definition and sometimes no. The multiplicity of terms and definitions illustrates the disagreement in an appropriated terminology.

2.1. The dichotomy between Western science and other types of knowledge

Despite the lack of agreement on definition and terminology, authors have engaged in an epistemological discussion about the dichotomy between Western science and other types of knowledge. With the term “knowledge” here I refer to the way people understand and interpret the world and provide meaning to their experiences (Arce & Long 1992 cited by Blaikie et al.1996). There are two main positions in the debate. Several authors have argued that TEK (to use one of the terms mentioned before) and Western science (WS) are two different bodies of knowledge that differ in substantive and perceptual ways (e.g. Berkes,F. and Folke, C. 1998; Berkes 1993; Chambers 1983; Gadgil and Berkes,F. and Folke, C. 1993; Hobart; Hunn 1993; Lyotard 1979; Scoones, I. and J. Thompson 1994; Toledo 2002). Table 1 shows the main characteristics that have been attributed to these distinctive bodies of knowledge.

INSERT TABLE 1 ABOUT HERE

In contrast to those who oppose Western science and traditional knowledge, other authors argue that those two types of knowledge are certainly different, but not necessarily opposed one to each other (Agrawal 1995). For this group of authors, both traditional knowledge and Western science are indigenous to a particular context, resulting of the same intellectual process of creating order

out of disorder (e.g. Agrawal 1995; Berkes 1993; Ellen, Roy and Harris, Holly 2000; Lizcano 2006). As other forms of knowledge, Western science was born in a certain place, inhabited by a particular people (Europeans) with a special worldview. Western science is embedded in the European imaginary and has its own morality (such as the current debates on bioethics). The exceptionality of Western science roots in its capacity to codify local wisdom, absorb folk knowledge, globalize its ideology, and turn ideology into unique truth (Ellen, Roy and Harris, Holly 2000; Lizcano 2006). The failure of many development initiatives based in Western science show the difficulty of using Western knowledge without understanding local social, cultural, and political contexts (Agrawal 1995).

Agrawal (1995) has argued that instead of opposing IK and WS, it might be better to accept differences within these types of knowledge and find a productive dialogue that synergistically combines the two. Agrawal (1995) and other authors (Blaikie et al. 1996; Descola 2002; Kalland 2000) propose a new paradigm where human beings and environment are no longer seen as separate and opposite entities but where organism and environment form part one of another. Under this new paradigm, medicinal knowledge can be mutually constructed between local people and external agents as doctors. This new paradigm recognizes the intrinsic value of local medicinal knowledge, but it also accepts that in some cases local medicinal knowledge may be less suitable than scientific knowledge. The main mechanism used to

promote the synergy between the two knowledge systems is the negotiation between all parties (Blaikie et al. 1996).

2.2. A conceptual clarification

A recurring challenge when discussing local ecological knowledge and convincing the scientific community of its merits is to define it (Gilchrist and Mallory, M. and Merkel, F. 2005). Below, I discuss some of the strengths and caveats of the most salient terms proposed by previous researchers.

Traditional Ecological Knowledge (TEK): Authors have widely used the term TEK. Berkes et al. (2000:1252) defined TEK as “a cumulative body of knowledge and beliefs, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and their environment”. Other authors have added to this definition by stating that TEK is based on information that comes from experience 1) of a certain cultural group accumulated over generations, 2) socially shared by the members of the same generation, 3) shared by the household, and 4) particular to each individual (Toledo 2002). TEK has also been considered an attribute of societies with historical continuity in resource use practices, which by large are non-industrial or less technologically advanced societies, many of them indigenous or rural (Folke 2004).

Although the term TEK is the most commonly used in the literature, it may not be the most adequate. Detractors of the term TEK argue that the word

traditional might give the idea of a knowledge that is static and rigid rather than dynamic and evolving. Detractors have argued that the knowledge hold by indigenous and rural people is not traditional but contemporary since it occurs at the same time that other types of knowledge such as WS (Woodley 2005).

Indigenous (ecological) knowledge (IK): To avoid the use of the word *traditional*, other authors have used the term IK. The word indigenous and its synonymous, native and aboriginal, refer to the first known inhabitants or beliefs and practices of an area, or to people oppressed by invaders defined in relation to a state (Kalland 2000). The problem that arises in using the term IK is that the knowledge hold by indigenous peoples has similarities with the knowledge hold by some groups of rural non-indigenous peoples. Therefore, although the use of the term indigenous ecological knowledge helps authors to avoid the debate about tradition versus contemporary, it overlooks the knowledge of rural societies.

Local Ecological Knowledge (LEK): Some authors have proposed the term Local Ecological Knowledge (LEK) to refer to non-Western knowledge because they argue that some of this knowledge has been acquired over the lifetime of individuals (Gilchrist and Mallory, M. and Merkel, F. 2005). The term local ecological knowledge basically shares the definition of TEK presented before, but avoids the debates generated by the use of words traditional and indigenous. In this paper I use the term local ecological knowledge. Since, I focus on the medical system; I specifically use local

medicinal knowledge to refer to the knowledge of the natural material from which remedies are produced and to the socio-medical aspects implied in their preparation and uses (Pieroni et al. 2004/12).

3. THE TSIMANE' AND THEIR MEDICAL SYSTEM

The Tsimane's are the third largest ethnic group in the lowlands of Bolivia, with about 8,000 people (Censo Indígena, 2001). The Tsimane' live in the Ballivian and Yacuma Provinces of the Department of Beni and their territory spreads from the foothills of the Andes to the northeast, reaching the edges of the Moxos savanna (14° 35'S-15° 30'S; 66° 23'W-67° 10'W). The Tsimane' have traditionally been a semi-nomadic group (Ellis 1996) but currently reside in villages of about 20 households settled along river banks and logging roads. Nowadays the Tsimane' way of live is rapidly changing because of external pressures from Catholic and Protestant missionaries and because of contact with non-Tsimane' population. The Tsimane', like other lowland populations that are being incorporated into the Bolivian economy (Jones 1995; Painter 1995), are increasingly confronting problems of land degradation, impoverishment, discrimination, and demographic change. The Tsimane' are considered a foraging-horticultural society because they still consume mostly forest goods and because of the importance of crops in household consumption (Godoy et al. 2002). Nevertheless, Tsimane' are now taking other occupations such as wage labor in logging camps, cattle ranches, and in the homestead of colonist farmers (Byron 2003; Reyes-García 2001; Tanner

2005). Tsimane' ethnographies can be found in (Ellis 1996), (Daillant 2003) and (Huanca 2007), so here I only offer a description of Tsimane' health and medical treatments.

3.1. Tsimane' health

Previous research (Byron 2003; Foster et al. 2005) suggests that infectious diseases are an important health problem among the Tsimane'. Respiratory and gastrointestinal diseases are the most commonly reported illness among Tsimane' children and adults (Byron 2003). Intestinal parasites, especially hookworm, a soil-transmitted helminth, are endemic among Tsimane' (Tanner 2005) and might be the cause of the chronic nutritional stress found within the Tsimane' (Foster et al. 2005).

In a previous survey done in the area in 2006 (TAPS, unpublished information), I found that 65 percent of people surveyed reported being sick during the seven days previous to the interview. Flu was the most common disease reported followed by gastrointestinal diseases. Fifteen percent of the participants reported having suffered from stomachache, diarrhea, vomit, and intestinal parasites during the seven days before the day of the interview.

The current process of integration to the national economy presents two additional threats to the already precarious Tsimane' health. First, previous research has shown that Tsimane' misuse pharmaceutical treatments (Tanner 2005). Most Tsimane' do not have the skills to purchase the appropriate drugs nor the knowledge to understand pharmaceutical treatments. As a

consequence, Tsimane' often do not use the appropriate drugs for their condition or use inappropriate dosages. Second, Tsimane' feel that they are losing local medicinal knowledge because this knowledge is not adequately learned by the young generation. Previous research has shown that Tsimane' ethnomedicinal knowledge is positively associated with indicators of own nutritional status (Reyes-García et al. 2008) and with better child health (McDade et al. 2007), so the loss of local medicinal knowledge might have adverse effects in Tsimane' health.

3.2. Tsimane' explanations for the causes of illnesses

Tsimane' consider that the world is dual and divided between the natural tangible environment and the supernatural or spiritual realm (Huanca 2007). This duality is embedded in all Tsimane' interpretation of the world, including the concepts of health and disease. The Tsimane' distinguish between common or casual illnesses and spiritual or caused illnesses (Silverstein 2006). Common or casual illnesses result from external or internal locus of cause, such as contact with hazardous agents or internally initiated imbalances. Spiritual or caused illnesses result of the purposeful intervention of a human or supernatural agent. Spiritual illnesses are named as "bush illnesses" (*daracansi*) and are the result of bewitch by angry spirits or the guardians of the natural environment (*jichi*) (Silverstein 2006). Casual illness does not necessarily oppose caused illness, but they have clearly distinct origins.

3.3. Medical treatments available to the Tsimane'

Tsimane' use at least three types of medical treatments. First, Tsimane' self-medicate with home remedies. Tsimane' hold an extensive ethnobotanical knowledge, medicine being the category in which they recognize the largest number of useful plants (Reyes-García 2001). For example, Tsimane' know up to 26 different plant species to cure diarrhea and up to 25 to cure worms. More isolated villages use more plants for medicine than villages closer to the market town (Reyes-García 2001). Although the Tsimane' know many medicinal plants, they do not use them frequently (Tanner 2005). Authors have argued that Tsimane' use few medicinal plants because they are increasingly substituting them by pharmaceutical treatments (Reyes-García 2001). Tsimane' believe in the curative power of plant remedies but they argue that they use them less than before due to the effort and time cost associated with gathering and preparing medicinal plants. Moreover, the depletion of the bush makes it difficult sometimes to access medicinal plants. Also, Tsimane' argue, the curative power of plant remedies is slower than the curative power of pharmaceutical treatments.

The second treatment option available to the Tsimane' is traditional healers. Tsimane' visit traditional healers or other local experts who can treat "bush illnesses". According to Byron (2003) traditional healers are a more economically feasible option than going to the hospital. Traditional healers can cure common diseases, but their importance lies in that they are the only ones who can cure spiritual illnesses (Silverstein 2006).

Third, Tsimane' also have access to biomedical options. Tsimane' get pharmaceutical treatments from pharmacies or stores in local market towns, from traders who visit their villages, or from other visitors to their villages (i.e. researchers, vaccination campaigns). Tsimane' have access to a hospital in the town of San Borja and a clinic at Horeb (30 minutes walking from San Borja) (Byron 2003).

3.4. Tsimane' use of medicine

Tsimane' consider that the cause of an illness conditions the type of treatment that should be used to cure the illness. Common illnesses, caused by the natural world, can be cured by medicinal plants or pharmaceutical treatments, whereas spiritual illnesses, caused by spiritual beings, can only be cured by the intervention of a traditional healer. When a person gets sick, the person is first treated as if she suffered from a common illness. Plants or pharmaceutical remedies are administered sequentially or simultaneously. Tsimane' self-medicate often, both with plants and with pharmaceutical treatments. As with medicinal plants, with pharmaceutical treatments Tsimane' typically stop the treatment once the disease symptoms disappears without following any prospect or doctors' advice. If the condition persists after self-medication, the Tsimane' typically ask for advice to the elder and more knowledgeable people of the village. Tsimane' start being suspicious that the illness is caused by witchcraft if the person does not improve after using several treatments, in which case, they seek the help of a traditional healer. Because Tsimane'

mistrust doctors, they only go to hospitals when they face a serious health problem that has not been cured by any other treatment.

For the scope of this study I focus on to four gastrointestinal diseases (stomachache, diarrhea, vomit, and intestinal parasites) for three main reasons. First, as we have seen in this section, gastrointestinal diseases are common among the Tsimane'. Second, gastrointestinal diseases are recognized as diseases both by ethnomedicine and biomedicine and have well identified symptoms. By selecting diseases that are well recognized by the two medical systems, I overcome the inability of the biomedical system to identify social, cultural, and behavioral factors as causes of diseases. Third, gastrointestinal diseases have a clear etiology among the Tsimane' who believe that they can be both causal and caused. Key informants reported that the origins of stomachache and vomit could be casual or caused, whereas diarrhea and intestinal parasites were never caused by bewitch. Because gastrointestinal diseases can be both causal and caused, and because Tsimane' condition the treatment to the origin of the ailment, gastrointestinal diseases represent a good choice to examine treatment decisions.

4. METHODS

Information for this article comes from data gathered during June-July 2007 in three Tsimane' villages along the Maniqui River, province of Beni, Bolivia. The research forms part of a panel study in progress (Tsimane' Amazonian Panel Study, TAPS) that dates back to 1999

(<http://people.brandeis.edu/~rgodoy/>). Data for this article was gathered by myself and by eight other participants in a summer training camp in methods in Bolivia. Three expert translators helped to conduct the interviews in Tsimane' and also served as key informants.

4.1. Site and sample

Participants for the study included people over the age of 16 in three Tsimane' villages: Yaranda, Santa María, and San Juan de Nápoles. Yaranda and Santa María are villages far from the market town and they are only accessible by one day trip on a motor canoe. Yaranda has 35 households and Santa Maria has 32. San Juan de Nápoles lies at about two hours by automobile from San Borja and has 14 households. San Juan de Nápoles differs from Yaranda and Santa Maria because residents in Nápoles have easier access to the hospital of San Borja and to the clinic in Horeb. Villagers from Nápoles also have less access to the forest due to increasing cattle ranging in the area. At the time of the research, electricity and running water were not available to any household.

I used different sampling strategies for each method of data collection described below. I used a snow ball sample for the free listings. In San Borja I started free listing by interviewing a nurse who has been collaborating with the TAPS project for several years. The nurse suggested further informants for free listings (n=6). In Yaranda, I started by asking my key informants to identify the village traditional healer or more knowledgeable person about

plants and pharmaceutical treatments (n=6). I conducted some additional free listings (n=6) to better capture Tsimane' domain of medical treatments. I used a purposive sample for semi-structured interviews and pile sorts that included people from different sex and ages. I conducted semi-structured interviews with six women and eight men from 23 to 75 years of age. I conducted pile sorts with 21 women and 18 men from 16 to 75 years of age. Last, I conducted a survey with all adults in households in the villages of Yaranda and San Juan de Nápoles, for a total sample of 87 people over the age of 16 (44 women and 43 men).

4.2. Methods of data collection

Methods of data collection included methods to 1) help me contextualize the research (participant observation and semi-structured interviews), 2) assess whether Tsimane' integrate ethnomedical and biomedical systems of knowledge at the conceptual level (free listing and pile sorting), 3) assess whether Tsimane' use ethnomedicine and biomedicine in an integrated way at the practical level (survey), and 4) assess the willingness to cooperate among specialists from both medical systems (workshop).

Participant observation. Participant observation is typically used to establish contact with the community, the culture, and the local social organization (Bessette 2004). I used participant observation to achieve an understanding of the diseases, treatments, and relations between different bodies of knowledge. For example, I helped providing medicines to people who came to us when

they were sick. This interaction with sick people allowed me to realize that Tsimane' often did not follow the instructions and misunderstood how to take doses.

Semi-structured interviews. Semi-structured interviews are interviews using a guide with suggested questions. The method is used to conduct interviews in which certain topics need to be addressed, but allows for more interaction than a formal survey or questionnaire (Bernard 1996). I used semi-structured interviews to gather information about the local medicinal knowledge, the causes of diseases, the use of medicines, and the potential interest in the cooperation between biomedicine and local medicine.

Free listing. This method consists in asking informants to list all different items that are included in a given category (Quinlan 2005; Weller and Romney 1988). I asked informants to list all the medical treatments they knew that could be used to treat gastrointestinal diseases. Lists included both ethnomedical and biomedical treatments. I asked doctors to free list medical treatments to get a better understanding of the treatments available for the Tsimane'. I also conducted free listings with Tsimane' villagers to get an understanding of Tsimane' own cultural domain of medical treatments. The final lists included both ethnomedical and biomedical treatments.

Pile sorts. From the list generated with the free listing technique, I selected the ten most frequent biomedical treatments reported and the ten most frequent ethnomedical treatments locally available (i.e., within three hours walking). The final list for pile sorts included nine plants, one stone, and ten

pharmaceutical drugs. To facilitate the identification of the items for the pile sort exercise, I collected the plant species in the forest and bought the drugs selected. I presented informants with the 20 items and asked them to sort the items in similarity groups. After, I solicited the informants to explain the bases of the classification for each group (Rocha 2005; Weller and Romney 1988).

Survey. With the information from participant observation, semi-structured interviews, and free-listing, I constructed a formal questionnaire. The survey included basic socio-demographic questions (age, sex, and schooling) and health questions. I asked all adults in the sample about the diseases suffered the week previous to the survey and the name of the first three treatments used for any gastrointestinal disease suffered during the week before the interview took place.

Workshop. At the end of the research, I organized a participative workshop. A participative workshop is a group communication tool used in participative research to solve conflicts, clarify objectives, and encourage the interaction between stakeholders (Steiner 1999). My workshop had three main objectives: (1) explain the findings of my own research, (2) identify the main challenges of the current Tsimane' health context and (3) assess the willingness to cooperate between practitioners of the biomedical and the ethnomedical systems.

4.3. Analysis

I analyzed the data from free listing and pile sorting using ANTHROPAC 4.983/X for Windows (Borgatti 1996). The analysis of free listing allowed to identify the most common treatments reported for the gastrointestinal diseases selected. Free listing results also let to establish the Tsimane' cultural domain of medical treatments. I analyzed pile sorting data with a non-metric multidimensional scaling (MDS) method. The MDS permits an observational assessment of whether there is agreement on the way people sort items in pile sort, medical treatments in my case. The closer the items are in the MDS the more times they were classified together in individual pile sorts. I analyzed survey data with descriptive statistics. Specifically, I run frequencies of the treatments employed by people.

4.4. Limitations and strengths of the study

This study has at least three limitations. First, I only spent seven weeks conducting field work for this study, which limited the amount of data I could gather. Second, the use of a translator for interviews included the obvious challenge of language barriers and the loss of information within the chain from the informant to the translator and finally to myself. Last, since I limited my study to gastrointestinal diseases, the selection of ailments could bias the results. It is possible that results found in this research apply to gastrointestinal but not to other diseases.

Data gathered have two main strengths. First, I could use background information and secondary data from the TAPS panel study. Previous

research on the area facilitated the setting and development of the study.

Second, by including my study as a part of the TAPS panel, I could easily access informants and get their trust and participation.

5. TSIMANE CONCEPTUALIZATION AND USE OF ETHNOMEDICINE AND BIOMEDICINE

5.1. Tsimane' conceptualization of the cultural domain of medical treatments

Results from free lists and pile sorts show that pharmaceutical treatments do not belong to the Tsimane' cultural domain of medical treatments. Tsimane' participants in the free listing exercise listed a total of 16 different treatments for gastrointestinal diseases. None of the Tsimane' participants listed any pharmaceutical treatment (Table 2). On average each informant listed 5.5 different treatments for gastrointestinal diseases ($SD=2.4$). The shortest list had 2 items and the longest 9. Oveto' (*Uncaria guianensis*) was singled out as the most important and salient item in the lists. Hundred percent of the people interviewed mentioned Oveto', and on average Oveto' was mentioned as the first item in free listing. Eleven treatments were listed by two or more people and five treatments were listed only by one person.

INSERT TABLE 2 ABOUT HERE

Results from pile sorting concur with results from free listing and further confirm Tsimane' conceptual divide between ethnomedicine and biomedicine.

Figure 1 shows results from a non-metric multidimensional scaling with pile

sort data from informants in three communities. Tsimane' differentiate between 1) different groups of medicinal plants to cure gastrointestinal diseases, 2) a stone, *curpa*, used to cure illnesses caused by witchcraft, and 3) a single group of pharmaceutical treatments that doctors recommend to cure gastrointestinal diseases. I found six groups among the nine medicinal plants used in pile sorting. The Tsimane' use *vejqui* (1)', *vuayuri* (3) and *oveto*' (4) to cure diarrhea and stomachache. They use *ibam'ta* (2) to treat stomachache and leishmaniasis (not a gastrointestinal disease). The Tsimane' use *vambason* (5), *mana'i* root (6), *ashasha* (9) to treat gastrointestinal diseases and other affections. For example, *vambason* is used in kidney affections, *ashasha* is used for colds, and *mana'i* is used to cure intestinal parasites. Tsimane' use *Titij'* (7) and *pofi* seed (8) to treat intestinal parasites. Thus Tsimane' classify medicinal plants according to the disease that the plant can cure. I also found that the stone, *curpa*, appears separated both from plants and pharmaceutical treatments. *Curpa* is used to heal spiritual illnesses, regardless of the symptoms presented by the person. Last, I found a single cluster that grouped all the items belonging to the list generated by biomedical practitioners. Tsimane' informants classified all the pharmaceutical treatments in a unique category basically because they do not know their use.

INSERT FIGURE 1 ABOUT HERE

To see whether the results from MDS held independently in each of the three villages where I collected pile sort data, I ran three non-metric MDS with data from each village separately. I found not substantive differences across

villages regarding the classification of plant remedies, but I found some differences regarding the classification of pharmaceutical remedies (results not shown). In the most isolated community, Yaranda, people sorted pharmaceutical treatments in a unique category (unknown), whereas in the other two communities, Santa Maria and San Juan de Nápoles, people recognized at least four categories for pharmaceutical remedies (headache, toothache, flu, and cold).

5.2. The Tsimane' use of medical treatments

Results from the survey suggest that, at the practical level, Tsimane' mix ethnomedical and biomedical treatments to cure gastrointestinal diseases. From the 87 people interviewed, 64 or 73.56 percent reported having been sick the week before of the interview. I analyzed information from the first ailment reported and found that the most common illnesses reported were cold (20.69 percent of the people who reported any ailment), headache (9.20 percent), and diarrhea (9.20 percent). Overall, 17.24 percent of people who reported any ailment suffered from gastrointestinal diseases, including diarrhea, stomachache (6.90 percent), and vomit (1.15 percent). None of the informants reported suffering from intestinal parasites. The distribution of ailments is similar to the distribution reported by Byron (2003).

From all the people that reported any gastrointestinal disease, 18.18 percent did not use any medicine to cure themselves. From the ones who used some treatment, 35.29 percent only used plant treatments and 17.65 percent only

used pharmaceutical treatments. The remaining 47.06 percent of the people who used any treatment to cure gastrointestinal diseases combined pharmaceutical treatments with plant treatments (Figure 2). Figure 3 presents information on the first treatment taken for gastrointestinal diseases. Results suggest that Tsimane' first rely on their ethnomedicinal knowledge. From the people who took any treatment for gastrointestinal diseases, 76.47 percent chose medicinal plants first and only 23.53 percent chose a pharmaceutical treatment first.

INSERT FIGURES 2 AND 3 ABOUT HERE

6. ASSESSING THE WILLINGNESS TO COOPERATE

In semi-structured interviews, both biomedical and traditional practitioners bet for a medical system that locally allowed cooperation between biomedicine and ethnomedicine. Biomedical and local practitioners independently agreed that some diseases (i.e., tuberculosis) could be better treated under the biomedical system, whereas for some other diseases (e.g. mild diarrhea) the local medicine could be more appropriate. Biomedical and local practitioners outlined that a system that allowed the collaboration of ethnomedicine and biomedicine could give patients the best option treatment for their disease. Biomedical and local practitioners also expressed motivation to learn one from each other, although doctors showed mistrust in the local medicinal knowledge arguing for the need to proof in a scientific way the properties of the plants.

To have a deeper understanding of the willingness to cooperate expressed by ethnomedical and biomedical practitioners, I organized a workshop with representatives of both health systems. I invited three doctors, one nurse, four traditional healers, and four health assistants to the workshop. However, more health assistants arrived due to the interest that stirred up the workshop, so the final number of participants was of 34 persons.

Participants elucidated the advantages of both medical systems, arguing that while the ethnomedical system was cheap, popular, and had implicitly the knowledge of various generations, biomedicine was effective and indorsed by scientific studies.

Participants in the workshop felt that health was a high priority and presented ideas to improve it. The most salient were (1) to train health' assistants in ethnomedicine and biomedicine; (2) to strengthen local medicinal knowledge; (3) to strengthen the role of traditional healers and health' assistants; (4) to open medical posts in communities; (5) to improve education and prevention of diseases; (6) to take care of the natural environment; (7) to build communal gardens of medicinal plants; and (8) to build some facilities as wells, latrines, and supply of potable water and electricity that might impact health.

Participants discussed the case of Apillapampa (Cochabamba, Bolivia) where a traditional healer works with the biomedical health care system and the community sells home remedies made with plants (Vanderbroek et al. 2004). The revalorization of local medicinal knowledge turned into one of the main points of discussion of the workshop since participants sensed that in the more

isolated communities plant remedies were the only health resource available. Participants felt that they could obtain an economic benefit with the revalorization of medicinal plants and also contribute to the conservation of forest. Participants considered that training workshops, revaluating elders, cooperating with doctors, institutional help, and the maintenance of customs, could help achieve the revalorization of ethnomedicine locally. Participants suggested that the workshop was the first spark to encourage the interaction between doctors and local health practitioners and highlighted the willingness to continue the process. They proposed immediate steps such as the construction of school gardens with medicinal plants; the share of elder's medicinal knowledge in schools, and the recompilation of local medical treatments within the communities. Participants are also planning to ask for municipals funds to conduct more workshops in which the relations between ethnomedicine and biomedicine could be further discussed.

7. DISCUSSION

Three main substantive findings emerge from this work. First, pharmaceutical treatments do not belong to the conceptual cultural domain of Tsimane' medical treatments. Second, at the practical level, Tsimane' mix pharmaceutical and plant treatments, but still favor plant over pharmaceutical treatments. Last, biomedical and local health practitioners show willingness to cooperate among them.

The first substantial finding, that Tsimane' do not include pharmaceutical remedies in the cultural domain of medical treatments, dovetails with findings in other case study in Tsimane' communities (Ticona-Contreras 2007). Ticona conducted an ethnobotanical research in the community of Tacuaral del Matos (35 kilometers away from San Borja). He found that Tsimane' do not include pharmaceutical treatments in the category of *Pinidyedyes* (medicine), although they interchangeably use the Spanish words *remedios* (treatments) or *medicinas* (medicine) and the Tsimane' word *Pinidy'e* to acquire drugs from traders or in pharmacies. A possible explanation of this finding is that since illness is a universal and recurrent problem and health treatments within a community are usually limited, community members might develop shared standards of treatment (Good 1994). Tsimane' have a limited access to biomedical treatments due to distance and low income. These limitations together with the short history of pharmaceutical treatments in the area might explain why Tsimane' do not include biomedical treatments in their cultural domain of medical treatments.

I also found that Tsimane' do not have categories for pharmaceutical treatments. The fact that Tsimane' do not have their own categories for pharmaceutical treatments dovetails with ethnographic information about Tsimane' misuse of pharmaceutical treatments. Because Tsimane' do not have a classificatory system for pharmaceutical treatments, they use biomedical treatments independently of the ailment suffered. This could have very

harmful effects in Tsimane' health, including the potential of the developing resistance to medications, as Tanner (2005) suggests.

The second substantive finding is that Tsimane' do merge ethnomedicine and biomedicine at the practical level. The explanation fits with the complex systems of responses related to the cultural beliefs and personal interpretation of symptoms and to resources available. For example, one of the informants said to me: "If I have money I buy tablets, but if I don't, I use medicinal plants. If nothing works, then I am probably sick with a bush illness. I rely more on medicinal plants than on drugs, but the bush is too far and the treatment too long" (personal interview 6/29/07).

Tsimane' frequent use of pharmaceutical treatments has increased with increasing contact with the Bolivian society in the last 50 years. Missionaries introduced the first hospitals and drugs in the area during the second half of the 20th century (Godoy, R. et. al. 2005). The powerful advertising of biomedical treatments' effectiveness might have certainly influenced the Tsimane' treatment choices, but it has not totally displaced the use of plant remedies. Furthermore, results from this research show that Tsimane' still prefer medicinal plants over pharmaceutical remedies as the first treatment for gastrointestinal diseases. Tsimane' might prefer medicinal plants over pharmaceutical remedies for cultural and for practical reasons. As stated before the pharmaceutical remedies are not included in Tsimane' cultural domain of treatments and some of the communities do not have easy access to

pharmaceutical treatments because of distance or lack of money then it is easier to Tsimane' to get plants to treat their illnesses.

The last finding worth discussing is the willingness to cooperate expressed by ethnomedical and biomedical practitioners. Previous research has highlighted the lack of trust among the ethnomedical and biomedical health systems in the area (Byron 2003). In my own research, I also found that Tsimane' express doubts over availability of free medication in the hospitals and have the misconception that hospitals are places to die. Tsimane' also express little faith in Western doctors due to poor past experiences. Similarly, biomedical practitioners manifest a misunderstanding of the health beliefs systems among the Tsimane' and claim for the need a scientific verification of the value of plant treatments.

Despite the current divide, there is a willingness to cooperate both from academic doctors and traditional healers. Doctors and healers felt that cooperation between ethnomedicine and biomedicine is important because they can complement each other. Collaboration of the two medical systems would allow Tsimane' to choose the best option treatment for each ailment. Furthermore doctors and traditional healers expressed motivation to learn from the other system of knowledge.

8. CONCLUSION

In this article I have analyzed Tsimane' treatment system for gastrointestinal diseases. I have found that the Tsimane' conceptualize ethnomedicine and

biomedicine as two independent domains of knowledge, although they mix pharmaceutical and plant treatments in their daily practice. I have also found that biomedical and ethnomedical practitioners show a great willingness to cooperate so people could benefit from both medical systems simultaneously. Science is provided with qualities of power, trust and effectiveness by the Tsimane' villagers and doctors. However a sense of revaluation of local medicinal knowledge is locally arising. Tsimane' feel that local medicinal knowledge helps to maintain Tsimane' lifestyle and conserve the ecosystem. Current Tsimane' lack of understanding of biomedical system rather than improving, has contributed to worsen Tsimane' health. For this reason the exploration of the connections between local medicinal knowledge and Western medicine and the possible co-management of health among traditional healers and doctors could lead to an improvement in the health situation as well as the conservation of their own ecosystem. This research can be the first step for future participatory research that attempt to create local institutions aiming to improve public health with the cooperation of the different health systems in the area, promote the biocultural conservation, and help the population to have medical sovereignty.

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Figure 1: Non-metric MDS of pile sorts of ethnomedical and biomedical treatments for gastrointestinal diseases.

Figure 2: Reported frequencies of treatments options for gastrointestinal diseases during the week previous to the interview (n=18).

Figure 3: Reported frequencies of first treatment option for gastrointestinal diseases during the week previous to the interview (n=18).

FIGURES

Figure 1

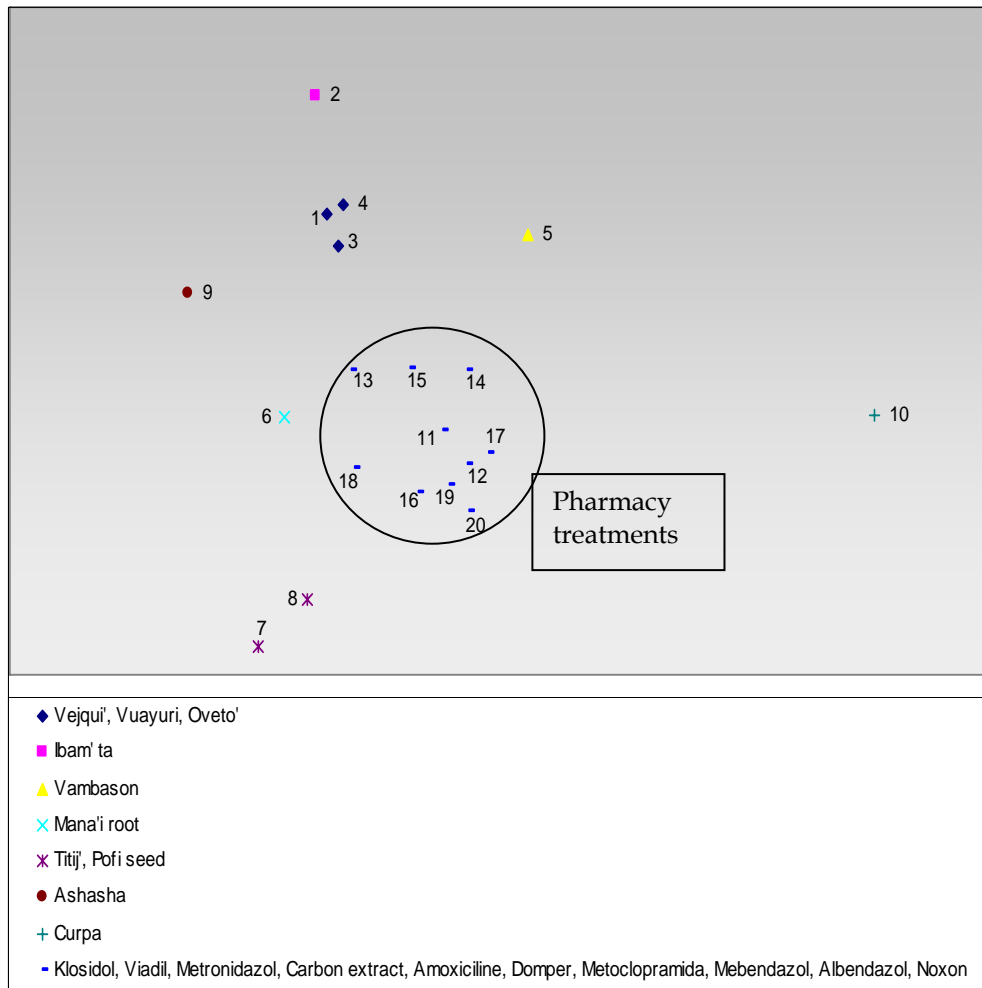


Figure 2

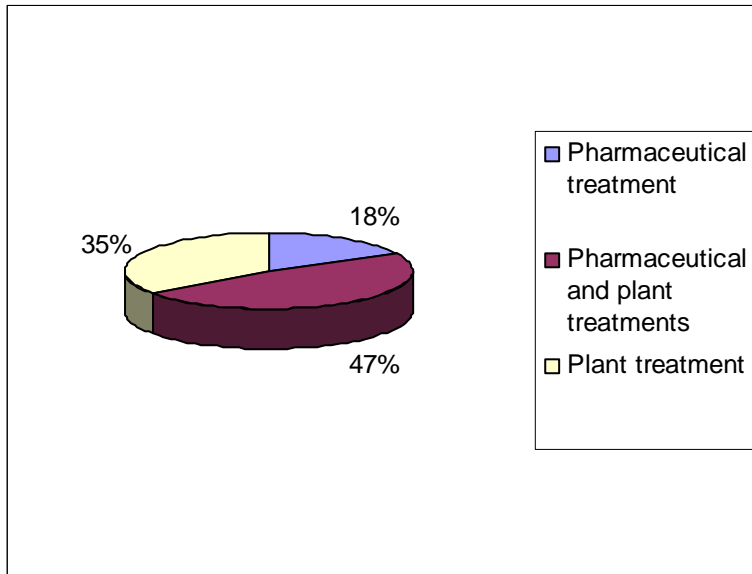
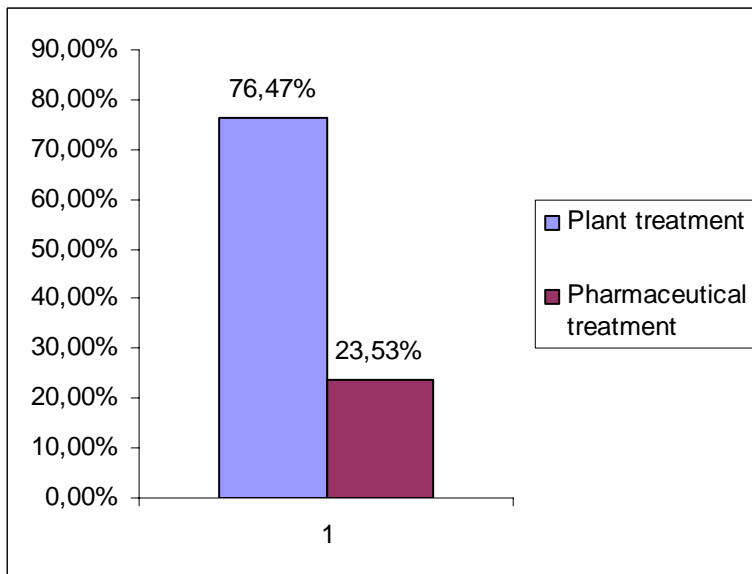


Figure 3



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Table 1: Comparison of characteristics Traditional Ecological Knowledge and Western Science for authors who oppose those types of knowledge.

Table 2: Ten most frequent items reported in free listings of gastrointestinal treatments by Tsimane' informants (n=12).

TABLES

Table 1

CHARACTERISTIC	Traditional Ecological Knowledge	Western Science
METHOD	QUALITATIVE	QUANTITATIVE
COMPONENT	INTUITIVE	RATIONAL
WORLD VISION	HOLISTIC	REDUCTIONIST
MIND AND MATTER CONCEPTUALIZATION	UNITED	SEPARATED
COSMOS CONCEPTUALIZATION	SPIRITUAL	MECHANISTIC
DATA GATHERING	TRIAL AND ERROR	EXPERIMENTATION AND SYSTEMATIC ACCUMULATION OF FACTS
DATA GENERATED BY	RESOURCERS	SPECIALIZED CADRE OF RESEARCHERS
TYPE OF DATA	DIACHRONIC	SYNCHRONIC

Source: Adapted from Berkes (1993) and Gadgil et al. (1993).

Table 2

TSIMANE' NAME	SCIENTIFIC NAME	Frequency	Salience	GASTROINTESTINAL DISEASE TREATED
Oveto'	<i>Uncaria guianensis</i>	7	0,292	Stomachache and diarrhea
Ibam'ta	<i>Galipea longiflora</i>	5	0,168	Stomachache and vomit
Vambason	<i>Aspidosperma rigidum</i>	3	0,125	Stomachache and diarrhea
Curpa	Alum. Double sulfate of Aluminum and Potassium	3	0,092	Stomachache and vomit
Titij'	<i>Ficus insipida</i>	3	0,150	Intestinal parasites
Vejqui'	<i>Hymenaea courbaril</i>	3	0,115	Stomachache and diarrhea
Pofi	<i>Carica papaya</i>	2	0,100	Intestinal parasites
Jamo'tarara	Unidentified	2	0,075	Stomachache and intestinal parasites
Ashasha	<i>Citrus lemon</i>	2	0,100	Diarrhea and vomit
Vuayuri	Unidentified	2	0,038	Diarrhea
Notes: Salience takes into account the frequency of a given item in lists and the average rank of the element in the respondents list. $S=F/NmP$				