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An assessment of the Bhutanese traditional medicine for its ethnopharmacology, ethnobotany and ethnoquality: textual understanding and the current practices

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Abstract

Ethnopharmacological relevance : This study involves the assessment of the Bhutanese traditional medicine (BTM) which was integrated with the mainstream biomedicine in 1967 to provide primary health care services in the country. It caters to 20-30% of the daily out-patients within 49 traditional medicine units attached to 20 district modern hospitals and 29 Basic Health Units in the country. Aim of the study : This study presents the ethnopharmacological, ethnobotanical and the ethnoquality concepts in relation to mainstream Tibetan medicine and describes the current practices of BTM. Materials and methods : Experienced BTM practitioners (Drung-tshos and Smen-pas) were selected using a convenience sampling method and were interviewed using an open questionnaire followed by informal discussions. The corpus of BTM, Tibetan and scientific literature was obtained and the information on ethnopharmacological, ethnoquality and ethnobotanical concepts and current practices of BTM was extracted. Results : This study found that the BTM shares many similarities in terms of materia medica, pharmacopoeia and the principles and concepts of ethnopharmacology and ethnobotany with its mainstream Tibetan medicine. However, the resourceful Bhutanese Drung-tshos and Smen-pas have adapted this medical system based on the local language, culture, disease trend, health care needs and their familiarity with the locally available medicinal ingredients making it particular to the country. A number of notable distinctions observed in the current practices include a code of classification of diseases (only 79 of 404 types of disorders recognized), formulations (currently used only 103 of thousands formulation types), usage of medicinal plants (only 229 species of thousands described) and selected treatment procedures (golden needle and water therapy). This BTM was found to cater to 20-30% of daily out-patients visiting 49 modern hospitals and basic health units in the country. Conclusions : The BTM has been evolved from the Tibetan medicine. While the pharmacopoeia, ethnopharmacology, ethnobotany and the ethnoquality aspects shares commonalities with the mainstream Tibetan medicine, there are some practices unique to BTM. Such uniqueness observed in the current practices of BTM include formulations, medicinal plants collection and usage, and the treatment procedures including golden needle and water therapy. This could be a promising source of information for the rediscovery of useful remedies, the development of modern phytotherapeutics and the establishment of efficient quality control measures.

Keywords

bhutanese, assessment, understanding, textual, ethnoquality, ethnobotany, ethnopharmacology, practices, its, current, medicine, traditional, CMMB

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**An assessment of the Bhutanese traditional medicine for its ethnopharmacology,
ethnobotany and ethnoquality: textual understanding and the current practices**

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ABSTRACT

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Aim of the study: This study presents the ethnopharmacological, ethnobotanical and the ethnoquality concepts in relation to mainstream Tibetan medicine and describes the current practices of BTM.

Materials and methods: Experienced BTM practitioners (*Drung-tshos* and *Smen-pas*) were selected using a convenience sampling method and were interviewed using an open questionnaire followed by informal discussions. The corpus of BTM, Tibetan and scientific literature was obtained and the information on ethnopharmacological, ethnoquality and ethnobotanical concepts and current practices of BTM was extracted.

Results: This study found that the BTM shares many similarities in terms of *materia medica*, pharmacopoeia and the principles and concepts of ethnopharmacology and ethnobotany with its mainstream Tibetan medicine. However, the resourceful Bhutanese *Drung-tshos* and *Smen-pas* have adapted this medical system based on the local language, culture, disease trend, health care needs and their familiarity with the locally available medicinal ingredients making it particular to the country. A number of notable distinctions include a code of classification of diseases (only 79 of 404 types of disorders recognized), formulations (only 103 of thousands formulation types), usage of medicinal plants (only 229 species of thousands described) and selected treatment procedures (golden needle and water therapy). This BTM was found to cater to 20-30% of daily out-patients visiting 49 modern hospitals and basic health units in the country.

Conclusions: The BTM has been evolved from the Tibetan medicine. While the pharmacopoeia, ethnopharmacology, ethnobotany and the ethnoquality aspects shares commonalities with the mainstream Tibetan medicine, there are some practices unique to BTM. Such uniqueness observed in the current practices of BTM include formulations (only 103), medicinal plants collection and usage (229 species), and the treatment procedures including golden needle and water therapy. This could be a promising source of information for the rediscovery of useful remedies, the development of modern phytotherapeutics and the establishment of efficient quality control measures.

Keywords: Bhutanese traditional medicine; medicinal plant; ethnopharmacology; ethnobotany; ethnoquality.

1. Introduction

In Bhutan, there are two forms of traditional healing systems: the *G.so-ba-rig-pa* medicine and the *Folk Medicine* or *Local Healing Systems*. The practitioners of the *Local Healing Systems* are known as *Folk* or *Local Healers* and include *Lamas* (accomplished Buddhist masters), *Gom-chen* (layman Buddhist practitioner), *Rtsip* (astrologer), *D.pao* (shaman), *Bon-po* (animistic practitioner), *Ru-to-thue-mi* (bone setters) and *Dug-jib-mi* (poison extractor). Except for highly accomplished Buddhist masters like *Lamas*, *Gom-chen* (layman Buddhist practitioner), *Rtsip* (astrologer) which mainly practices spiritual healing system, rest of the *Local Healing Systems* are primarily based on oral traditions passed down from generation to generation, from father to son and master to apprentice. The practitioners of *G.so-ba-rig-pa* medicine are known as *Drung-tshos* and *Smen-pas*. The Bhutanese *G.so-ba-rig-pa* medicine was adapted from a Tibetan scholarly education system. This medical tradition has documentation of its principles, pharmacopoeias, diagnostic procedures and treatment regimens.

Until the advent of modern allopathic medicine in the 1960s, *G.so-ba-rig-pa* medicine and the *Local Healing Systems* have been the sole health care providers (Wangchuk, 2010). Their practices are still widespread in the country and the recent article by Pelden (2012) which reported the existence of 1,683 *Folk Healers* and 112 *G.so-ba-rig-pa* practitioners alongside 1,593 modern health care providers supports this. This study deals with the Bhutanese form of *G.so-ba-rig-pa* medicine or popularly known as Bhutanese Traditional Medicine (BTM).

The BTM was officially recognized and integrated with the mainstream biomedicine health care services in 1967 and today this medical system operates under the guardianship of the Institute of Traditional Medicine Services (ITMS). The ITMS has three main components, the National Institute of Traditional Medicine (NITM) which trains human resources for carrying out the BTM services, the Manjong Sorig Pharmaceuticals (MSP)

which collects medicinal plants and manufactures medicines, and the National Traditional Medicine Hospitals (NTMH) which deliver traditional medical services. The NTMH caters to 20-30% of the daily out-patients within 49 traditional medicine units attached to 20 district modern hospitals and 29 Basic Health Units in the country (Wangchuk et al., 2007a).

Since BTM plays a significant role in the primary health care services of the country, the Ministry of Health in Bhutan emphasizes the improvement of the quality, safety and efficacy of its medicine through scientific studies. Therefore, with the aim of generating good scientific data to assist this cause, we have recently engaged in studies of selected medicinal plants used in BTM. The findings in terms of ethnobotanical identification, phytochemical content and biological activity studies were previously reported (Wangchuk et al., 2007b, 2008, 2010a, 2010b, 2011a, 2011b, 2012a, 2012b). These studies required us to first gain an intimate understanding of the BTM, its *materia medica*, pharmacopoeia, concepts, ethnoquality, medicinal plants and its current practices in Bhutan. Therefore, we studied the BTM methods, traditional literature, current BTM practices, BTM practitioners' views and analyzed them with a modern scientific perspective. The outcomes from this study are reported here and are expected to influence our ongoing experiments, guide future scientific research and facilitate comparative studies of the *G.so-ba-rig-pa* medicines practiced in other countries.

2. Materials and methods

Five selected BTM practitioners called *Drung-tshos* (Traditional Physicians or Doctors) and *Smen-pas* (Traditional Clinical Assistants) with vast experience in the areas of traditional clinical practices, herbal formulations, field identification and collection of medicinal plants were interviewed using a convenience sampling method and an open questionnaire followed by informal discussions. The current practices of BTM were also

observed. The literature belonging to BTM (Dorji, and Morisco, 1989; Anonymous, 1999; Tenzin, 2007; Wangdi and Wangdi, 2007; Krug, 2008; Wangchuk, 2008; Gayleg et al., 2010) and the Tibetan *G.so-ba-rig-pa* including Tibetan-based *Amchi* medicine (Choeda, 1989; M.gonpo, 1992; Chopel, 1993; Phuntshok, 1994; Dorji, 1995; Ghimire et al., 1999; Dawa et al., 2001; Lama et al., 2001; Boesi 2005 & 2006; Dekhang, 2008) were consulted. This paper was also proof-read by the Bhutanese *Drung-tshos* and *Smen-pas* for its accuracy of BTM information.

3. Results and discussions

3.1. Overview of BTM

The origin and the pharmacopoeias of BTM is closely related to the mainstream Tibetan *G.so-ba-rig-pa* medicine and has been previously reported (Dorji and Morisco, 1989; Wangdi and Wangdi, 2007; Wangchuk et al., 2007a; Wangchuk, 2008). From our analyses of traditional literature, we found that *Rgyud-zhi* (Four Root Medical Tantras) (Choed, 1989; M.gonpo, 1992), *Shel-gong-shel-phreng* (Phuntshok, 1994) and as many as 26 other Tibetan contemporary *G.so-ba-rig-pa* related books are in use at the National Institute of Traditional Medicine (NITM) in Bhutan. We found that the concepts and principles of the BTM ethnopharmacology and the ethnobotany to be no different to that of the Tibetan medicine, and these are described here briefly.

Ethnopharmacologically, there are four universal principles: 1) the principle of five cosmo-physical elements (*byung-ba-nga*); 2) the principle of three humors (*nad-pa-g.sum*); 3) the principle of astrology (*rtsi*); and 4) the principle of binary opposition of intrinsic hot-cold quality (*tsha-brang-byung-ba*). Etiologically, about 404 disorders are recognised which are classified into four major categories as: 1) afflictions by spirits (*kuen-rtag-g.don-gyi-nad*); 2) sufferings originating from bad karmic actions of a previous life (*g.shen-d.bang-sgon-les-kyi-nad*); 3) minor ailments that heal by themselves without

requiring major medical intervention (*star-s nang-' phrel-gyi-nad*); and 4) life threatening diseases based on the principles of the three humors (*yongs-grub-tsheyi-nad*). The *kuen-rtag-g.don-gyi-nad* and the *g.shen-d.bang-sgon-les-kyi-nad* are mainly dealt within the *Local Healing Systems* (not described here), the *star-s nang-' phrel-gyi-nad* and the *yongs-grub-tsheyi-na* are principally dealt by the BTM. These diseases are diagnosed through pulse reading, urine analysis, examination of the physical changes and studies of the patient's medical history.

Ethnobotanically, both BTM and the Tibetan medicine consider the five cosmo-physical elements (earth, water, fire, air, and space) as the vital components responsible for the growth of medicinal plants. It is only the matter of balance in these elements that would determine whether the plant is healthy, diseased, toxic or medicinal. Therefore, these five cosmo-physical elements determine the properties (*yon-tan*) like taste (*ro*), smell (*grim*), main constituents (*zes-'jor*), potency (*ngo-bo-nus-pa*), quality (*pue-tshey*) and other traits of a medicinal plant. In terms of ethno-taxonomical and plant identification framework, we found that the BTM system was similar to what has been described by Boesi (2005, 2006) whose works were based on Tibetan *Rgyud-b.zhi* and *Shel-gong-shel-phreng*. Similar ethnobotanical framework focusing on *G.so-ba-rig-pa* practiced by *Amchis* of Dolpo in Nepal was also reported by Lama et al. (2001) and Ghimire et al. (1999).

While there are many similarities between the mainstream Tibetan medicine and BTM, we also found that there are some practices specific to BTM. The Bhutanese *Drung-tshos* and *Smen-pas* believe that the local beliefs, culture and traditions, and the constant processes of review, adaptation, innovation and evolution made the BTM particular to Bhutan. Such variations are to be expected as the *materia medica* of the mainstream Tibetan medicine should not be considered as standard and static both in time and space, but as a tradition that has been constantly evolving in several countries with its adaptations

to local vegetation, culture and foreign influences (Boesi, 2006). The language of a community or a country is also an important factor that can affect description, identification and classification of a plant. For example, the *G.so-ba-rig-pa* medical practitioners in Bhutan are known as *Drung-tshos* and *Smen-pas*, in Tibet as *Gso-gyad* and *Smen-pa*, and in Dolpo (Nepal) and Mongolia as *Am-chis* and *Olamjila Emchi*, respectively.

One of the notable differences is that, the BTM have segregated the medical services, training, and the collection and processing of medicines. The MSP is responsible for the identification, collection and formulation of medicines. To supplement the students' theoretical knowledge, the NITM in collaboration with the MSP, organizes field trips to various medicinal plant collection centres. The MSP also provides apprenticeships or internships for the students of NITM, during which the students learn and experience about the protocols of the *G.so-ba-rig-pa* and the botanical identification of medicinal plants.

Other examples of BTM specific practices as pointed by the participants of this study are: 1) acupressure therapy that uses *G.ser-khab* (gold needle) and *D.ngul-khab* (silver needle) was innovated by a Bhutanese *Drung-tsho* Sherab Jordan based on the principle of Tibetan treatment procedure called *Spra-ba* (moxibustion) (Dorji and Morisco, 1989); and 2) some health problems, current formulations and the medicinal ingredients, and the processing methods are slightly different to the mainstream Tibetan medicine. Currently, large scale production equipment and methods have replaced the ancient small scale mortar and pestle-based preparation of medicines. The recent Bhutanese traditional classification of diseases and related health problems (Gayleg et al., 2010), identified and recognized only 79 diseases. Similarly, out of thousands prescribed in the mainstream Tibetan pharmacopoeia, only 103 formulations were selected and modified to suit the current needs of the formulation in Bhutan (Tenzin, 2007). The

selection of these 103 formulations was strictly based on the prevalence and the trend of the diseases (79 types of diseases) in the country. These formulations use only about 300 types of locally available medicinal ingredients, the bulk (229 types) being medicinal plants (Tenzin, 2007). The *Drung-tshos* and *Smen-pas* generally classify the medicinal plants as: 1) high altitude medicinal plants (HAMP) (*sngo-smen*) comprising 116 species; 2) low altitude medicinal plants (LAMP) (*khrog-smen*) comprising 113 species; and 3) plant exudates (*rtsi-smen*) (Wangchuk et al., 2008, 2011b). The participants of this study estimated that about 30-40% of these medicinal plants are different from the mainstream Tibetan medicine formulations.

3.2. *Current practices*

3.2.1. *Treatments and medications*

A recent study by Lhamo and Nebel (2011) on the perception and attitudes of the Bhutanese towards the BTM health care services reported that 51% of 155 respondents of the study were being treated by the *G.so-ba-rig-pa* practitioners and about 83 % of them were satisfied with the traditional services provided by BTM. This finding suggested that the BTM is still an effective tool for treating various diseases in Bhutan. To treat the diseases, the *Drung-tshos* and *Smen-pas* generally employs four main treatment procedures such as correction of diet, modification of behavior, medication and the five accessory physiotherapies (*Les-nga-pyad-nga*) (Wangchuk et al., 2007a). When interviewees were asked which treatment methods mentioned above are popular and effective, the participants remarked, “We found *les-nga-pyad-nga* (five accessory physiotherapies) to be more popular among the patients and they are very effective especially for treating chronic diseases such as sinusitis, arthritis, rheumatism and the diseases related to the digestive and nervous systems. The patients come for this treatment when modern medicines fail to cure their diseases.” This was further supported by the

2011 patient records maintained by the TMHs (NTMH, 2011) which listed the top five traditional diseases as: neurological problems (*tsa-d.kar*), sinusitis (*ya-khrag*), stomach disorders (*pho-nad*), arthritis and rheumatism (*brum-bu*), and the skin diseases (*chuser-pak-nad*).

The medications for treating the diseases are prepared using medicinal ingredients belonging to five major categories: 1) medicinal plants (*shing-smen*) (bulk ingredient); 2) precious gem stones and metals (*rin-po-che-smen*); 3) minerals (*rdo-smen*); 4) medicinal soils (*sa-smen*); and 5) animal parts (*srog-chags-smen*). The gem stones include cat's eye, turquoise, emerald, ruby and sapphire. The precious metals include gold, silver, copper, bronze and iron. The minerals includes mineral stones, ores, rock exudates and base minerals including rock and sea salts. About 18 types of medicinal ingredients belonging to precious gem stones, metals, minerals and medicinal soils are used in the current formulations. The animal parts include the parts and products of four footed animals (mainly milk, blood, bile, bone and horn), birds (mainly meat), insects (whole parts), insect-fungi (whole parts), reptiles (mainly meat and skin) and marine organisms (mainly crab, pearls, seashells and corals). About 35 different types of animal products are used in the current formulation of BTM. Some rare animal parts such as rhinoceros horn, tiger bone, elephant tusk and musk are banned from use in the herbal formulations. Our analysis of the current formulations revealed that different types of medicinal ingredients are mixed in specific proportion and then processed into different dosage forms including pills (*ril-bu*, 39.8%), tablets (*gor-lab*, 30.1%), capsules (12.6%), powders (*phye-ma*, 3.8%), ointments (*byug-smen*, 3.8%), decoctions and syrup (*thang*, 2.8%) and un-established dosage forms (6.8%). Except for capsules and tablets (both modern dosage forms), the other dosage forms are traditionally described and prescribed. The participants noted that all medicines should preferably be taken with hot water. They also stated that if an ailment persists even after prolonged adherence to this medication treatment, the patients are

referred to undergo the five accessory therapies which include emesis, purgation, nasal irrigation, enema and minor surgical procedures (bloodletting, cauterization, moxibustion and needle acupuncture therapy). The *Drung-tshos* and *Smen-pas*, in general, believe that such therapies not only remove toxins from the body, but can also combat the latent disorder fully and act as a prophylactic by improving the bodily system to avoid future recurrence. Amongst the five accessory physiotherapies, hydrotherapy (*Chu*) treatment is considered most popular treatment procedure. The hydrotherapy comprises of bathing in four categories of water: 1) medicinal water (*Smen-chu*); 2) hot springs (*Tsha-chu*); 3) sanctified spring water (*Drub-chu*); and 4) five herbal elixir steam water (*B.dud-rtsi-nga-lum*). While *Tsha-chu* is hot spring water usually found in volcanically active areas, *Smen-chu* is cool medicinal water rich in natural minerals such as sulphur, phosphorus and iron that are associated with a pungent aroma and are usually found in marshy areas. *Drub-chu* is holy spring water believed to be unearthed by *Drub-thops* (enlightened beings) or eminent *Lamas* through their arduous meditation or miraculous activities (Wangchuk, 2010). These three healing types of water (*Tsha-chu*, *Smen-chu* and *Drub-chu*) are therefore regarded sacred and are generally believed to cleanse away sins and heal mental and bodily disorders. So far, about 10 *Tsha-chu*, 14 *Smen-chu* and 16 *Drub-chu* have been recorded in Bhutan (Wangchuk, 2010) and the search for other sacred sources is continuously pursued by the *Drung-tshos* and *Smen-pas*. Although visits by patients to these three water treatment sources are popular, no patient records have been maintained to date by the *Drung-tshos* and *Smen-pas*.

B.dud-rtsi-nga-lum is man-made medicated water which is prepared by the *Drung-tshos* and *smen-pas* using mainly five important herbal ingredients. It is comprised of four types: herbal bath (*chu-lums*), herbal steaming (*rlang-lums*), localized steaming (*rlang-dhugs*) and herbal compress (*ching-lums*). The 2011 patient records of NTMH (NTMH, 2011) showed that 11,280 patients were treated by localized steaming, 4,136 patients by

herbal steaming, 3,338 patients by herbal bath and 165 patients by herbal compress. Judging by the number of patients, it appeared that the localized steaming method was the most popular type of *b.dud-rtsi-nga-lum*. However, when *Drung-tshos* and *Smen-pas* were asked whether these patients numbers reflect the popularity of the treatment types, they responded “The most popular method so far is *chu-rlums* or herbal bath since it is unique and effective in treating all kinds of diseases. It also provides relaxation to the stressed mind and body. However, this treatment procedure is not recommended for pregnant mothers, patients with high blood pressure, diabetes and jaundice.”

3.2.2. Ethnoquality and the collection of medicinal plants

The BTM protocols to identify, evaluate and grade the quality of medicinal plants includes: 1) morphological observation of a plant such as shape, size, cutting appearances and texture; 2) distinguishing characteristic/traits of the plants; and 3) assessment of the organoleptic properties of a plant such as color, aroma and taste (sweet, sour, salty, bitter, pungent and astringent). Following these three main parameters, the qualities of the medicinal plants are graded as superior (*smen-m.chog* or *rab*), medium (*smen-dring-ma*) and inferior (*smen-smen-pa* or *smen-tha-ma*). The grading of these plants is also considered in accordance to the needs of the formulations. For example, *Punica granatum* L., when it is used in formulations for treating air/wind disorders, its fruit with a sour taste is believed to be of high quality as opposed to its fruit which has a sweet taste. To support the ancient method of identification and quality control system, the MSP has recently incorporated the modern quality parameters such as macroscopy, microscopy, physiochemical (e.g. total ash value, moisture content, loss on drying, essential oil content) and comparative thin layer chromatography analysis.

The *Drung-tshos* and *Smen-pas* believe that the quality of plants at a particular location largely depend on strict adherence to the ethnoquality guidelines called ‘seven

branches of affectionate practices' (*g.ches-pai-yan-lag-b.dun*) (Wangchuk et al., 2008) and include: 1) choosing and identifying the correct medicinal ingredient; 2) collecting medicinal plants from the pure natural habitat; 3) collecting the medicinal plants in an appropriate season and time; 4) pre-processing and detoxifying the toxic plants using relevant methods; 5) drying using suitable methods; 6) storing of dried medicinal plants under appropriate conditions; and 7) spiritual empowerment.

From the interviews and informal discussions, we learnt that MSP have adopted and implemented the above seven branches of affectionate practices as evidenced from the following. For choosing and identifying the medicinal plants correctly, the MSP have employed one full time *Drung-tshos* and two *Smen-pas* who all have vast experience (more than 45 years) in the area of identification and collection. The participants of this study representing MSP, said that prior to every collection season of medicinal plants, they calculate the exact quantities of each of the 229 medicinal plants (15-17 tonnes in total annually), get the blanket approval for their collection from the Ministry of Agriculture, Thimphu, Bhutan, and organize the field plant collection team from MSP to accompany them to the collection sites.

For ensuring that the medicinal plants are collected from a pure and acceptable natural habitat, we were informed by the participants that the MSP have chosen Lingzhi under Thimphu district and Lanthel under Trongsa district as the main collection centres for HAMP and LAMP, respectively. Our field trips to these collection centers verified their notable purity and pristine environments with pleasant climate and fertile land which supported abundant medicinal plants growth. While almost all the 116 HAMP are sourced from within Bhutan from an altitude range of 2000 to 5000 meters above sea level (masl), only 85 LAMP are sourced within Bhutan from an altitude range of 150 to 1999 masl and the remaining 28 LAMP are currently imported from India (Wangchuk et al., 2011b). The *Drung-tshos* and *Smen-pas* said that the acceptable collection site must not be affected by

frost, hailstorm, drought, fire, insects, harmful and hazardous substances nor should it be a burial or cemetery ground, waste disposal or polluted site, a place of human dwellings, or the dwelling place of local deities or spirits.

The *Drung-tshos* and *Smen-pas* from MSP who participated in this study stated that they established the collection seasons for HAMP as June-September and for LAMP, as December-February. They stated that, during these collection seasons, an auspicious day is selected, most preferably on the ascending date of the month of the Bhutanese calendar year as the 8th, 10th and 15th day (*g.yar-sngo*). In olden days, *Drung-tshos* and *Smen-pas* picked the medicinal plants themselves. However, today the MSP carries out the bulk collections of medicinal plants with the help of the farmers mainly for the following reasons: 1) the quantities of medicinal plants required by MSP are high and it is impossible to collect the required amounts by the practitioners or MSP collection team; and 2) the MSP framed a policy to improve the income and livelihood of the farmers living in and around the catchment areas of medicinal resources by engaging them in the collection and cultivation programs. We observed that, during the collection season, the collection team from MSP meets with farmers or yak herders and the list of medicinal plants to be collected are distributed among the farmers in the meeting. These farmers are trained by MSP on the good collection methods (*g.ches-pai-yan-lag-b.dun*) and were informed to take precaution of not collecting the medicinal plants during rain, storm, solar or lunar eclipse and ill-omened days (as deemed by the Bhutanese calendar year) such as the meeting of the nine evils (*ngyan-pa-d.gu-'zom*). Some of the medicinal plants requiring picking at a specified time of the day (for example at night in the presence of moonlight) are being picked by the *Drung-tsho* and *Smen-pa* themselves.

The medicinal plants collected by the farmers are brought to the nearby drying centers where the collection team (*Drung-tshos* and *Smen-pas*) of MSP carry out pre-processing, which includes sorting, cleaning, washing, sizing and chopping. The sizing

and chopping involves the removal of components believed to be harmful such as bark, thorns, nut shells and dead plant parts. The smoothening and detoxification process is performed on selective medicinal plants and we found that only handful of *Drung-tshos* and *Smen-pas* have the abilities and skills of carrying out these processes.

The preprocessed medicinal plants are then dried either in the sunshine, or shade or by a fire (at present this is replaced by oven drying) depending upon the type of formulations. While the plants with cool quality (sensitive to light) are dried in cool, shady, dry and well ventilated places, the plants of warm qualities are dried in the sunlight or in hot air (oven). The collection team transport these dried plant materials to the MSP in Thimphu where they are offered to the Medicine Buddha for spiritual empowerment. These precious materials are finally stored using modern packaging and storage materials before dispensing for formulations and manufacturing.

Overall, we observed that the current medicinal plant collection programs and BTM practices benefits many stake holders including farmers/yak herders, traditional health care providers, MSP, other herbal traders and many herbal-based businesses. In fact, we found that the BTM is one of the sustainable practices upholding one of the pillars of the country's development policy of Gross National Happiness (GNH). The BTM depicts country's rich traditional heritage and sustain on the country's resourceful biodiversity where people are the major players and benefactors. While the participants were optimistic about the benefits of BTM especially to those farmers/yak herders who collect medicinal plants, they were worried about many challenges the BTM is facing currently. One of the challenges is securing the farmers/yak herders who could permanently collect for MSP. They pointed out that due to the legalization of the collection of high value medicinal *Cordyceps sinensis* (market value of US \$10,000-16000 per kilogram of dried material), not many yak herders are interested to collect those low value medicinal plants (US \$5-10 per kilogram of wet material) for MSP.

4. Conclusions

The BTM belongs to the larger corpus of Tibetan *G.so-ba-rig-pa* medicine. However, the resourceful Bhutanese *Drung-tshos* and *Smen-pas* appears to have adapted this medical system based on the local language, culture, disease trend, health care needs and their familiarity with the locally available medicinal ingredients making it particular to the country. The BTM, as embodied in Tibetan medicine, has well documented pharmacopoeae, and practical concepts and principles of ethnopharmacology, ethnobotany and ethnoquality.

The BTM provides primary health care services to significant number of patients in the country. Among the traditional medical services, *Les-nga-pyad-nga* was found to be the most popular services among the patients. This may be due to the fact that it has been found effective in treating most of the chronic disorders, some of which are not even treatable by modern biomedicine. The traditional perspectives of ethnoquality of medicinal plants are based on four main quality aspects such as macroscopy, organoleptic properties, the plant traits and the ethnoquality doctrine known as ‘seven branches of affectionate practices’. Generally, the Bhutanese treat the medicinal plants as sacred with powers to keep the diseases at bay and uphold one’s health. Some of the participants of our study remarked that “Having the sandalwood (*Tsan-den-shing*) planted in one’s homestead would expel the illness from home and fetches the prosperity and the longevity.” They believe that the feces, urine and walking over medicinal plants are sinful acts and that the collection of medicinal plants is a good deed. With such beliefs imbued in the mind set of the *Drung-tshos*, *Smen-pas* and the farmers (collectors), the quality of medicinal plants used in BTM appeared to be unsurpassable. The four quality parameters are much simpler, faster, easier and are effective tools for assessing the quality of medicinal plants and therefore should be continuously carried on to supplement the modern medicinal plant quality parameters (microscopical, TLC fingerprinting and phytochemical measures).

Some of the traditional medical concepts, processing methods and the medicinal formulations have the potential for applications in modern medicine and drug discovery and therefore warrant protection and patenting. In immediate terms, establishing a code of diseases and disease classification system in alliance with the World Health Organization, and developing TLC profiling and metabolomic fingerprinting of the secondary metabolites of the medicinal plants that are collected by strictly employing ‘seven branches of affectionate practices’ are essential. These could serve as a blueprint for establishing standard quality control measures for BTM. While current consumption of medicinal plants have been reported to be sustainable (Wangchuk and Annette, 2010-2011), it may not be so in near future because of the many burgeoning plant-based industries in Bhutan. This calls for urgent studies on establishing the supply-chain analysis of medicinal plants in Bhutan. The BTM also provide important new avenues for clinical research and new drug discovery based on the country’s rich biodiversity (Stone, 2010). The ethnomedical and ethnobotanical information described here would guide current phytochemical and biological activity studies of Bhutanese medicinal plants which are now under active investigation.

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