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Review Article

Traditional Chinese Medicine Going Global: Opportunities for Belt and Road Countries

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Abstract: Due to Belt and Road Initiative, Traditional Chinese Medicine (TCM) a 2,000-year-old Chinese national treasure is experiencing a fresh thrive. By 2020, China aims to issue 20 TCM international standards, register 100 TCM products and build 30 overseas TCM centres in BRI (Belt and Road Initiative) countries. BRI initiative is intended to expand TCM understanding and increase exchanges between researchers and healthcare professionals, for instance, through a new hospital alliance and a health policy research network. Worldwide trade in TCM services, including clinic treatment, education and training, and health tourism is estimated to be at about $50 billion. TCM has become a vital area of health and trade cooperation between China and the ASEAN, EU, Africa, and Central and Eastern Europe. In the present scenario, BRI countries (~70) also have the opportunity to promote their own traditional and complementary medicine systems globally such as Ayurveda, homeopathy, and unani medicines. A flagship project of BRI, China–Pakistan Economic Corridor (CPEC) Pakistan is intended to rapidly modernize infrastructure of Pakistan and strengthen its economy through diverse projects with the value of ~ $62 billion as of 2017. In this scenario, it's vital for the herbal practitioner's, scientists, industry and policy makers in Pakistan to explore the opportunity given by BRI and CPEC to promote the herbal industry by forging the practices of TCM. This will result in a massive move towards the achievement of SDGs (Sustainable Development Goals) globally and will nurture herbal industries to develop on solid scientific and legal grounds.

Keywords: Traditional Chinese medicine (TCM), Belt and Road Initiative, Ayurveda, Homeopathy, Unani medicine, SDGs, China–Pakistan Economic Corridor (CPEC).

1. TRADITIONAL CHINESE MEDICINE (TCM): MYTHS AND REALITIES

Traditional Chinese medicine (TCM) is practiced in China for over thousand years. It is believed that Chinese medicines started from the time of Shen Nong, who was the ruler in ancient China and was known for his knowledge of plants. He identified hundreds of plants and also found some poisonous plants at that time [1]. Huangdi Neijing is the first record of Chinese medicines written in 3rd century BCE, which are used to day to provide the basic concept and usage of Chinese medicines. Traditional Chinese medicine is not only confined

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to medicinal plans but it is also associated with the beliefs, philosophical theories and therapies such as Chinese acupuncture exercise and diet. These methods of practices are still in use in many countries of Asia as well as in Western world.

In the era of Shang (1600 BC) the Chinese philosopher started collecting information about plants regarding the practices of TCM. At that time alcohol was introduced in the medical field as great discovery which was used as solvent for enhancing the curative effect of medication. The process of decoction was also introduced in the same era of Shang, by making liquid medicines. The earliest books in which different kind of plants were recorded with respects to its habitat, localities, medicinal and edible properties were published as "The Book of Songs" and "The Book of Mountains and rivers". However, the Chinese were greatly influence with the idea of the great philosophers Confucius and Laozi and other leaders who knew and understood the function of the body and the surrounding environment [2]. The Chinese tradition is mostly based on stories about the cultural heroes who taught the useful things to their offspring and the wider community and it passes from generation to generation orally [3]. A book "Yellow Emperor's Classic of Medicines" written by Huang Di (206 BC-220AD) is considered as the symbol of medical theories in China. Patricia B. Ebreyin her Book "Chinese Civilization (1993) quotes about the medical theory of "Yin" and "Yang". Similarly, the Chinese culture is rich of many mythical stories and belief about the TCM, its usage, identification of poisonous and non-poisonous plants. However, some healing techniques in Chinese medicines are very significant with respect to disease identification. For example, the determination of pulse rate was a significant factor for disease determination and this technique adopted by Korean, Japanese, lately spread to the Arab and Persian world and now it is considered as very important factor in the modern-day Western world [4]. Some authors have made great comparison in some techniques between China and Europe and they found that Chinese were much earlier aware of some techniques that are known to European today. For instance, Chinese acupuncture, which was developed almost 2500 years ago, attracted the attention of Western patients and medical professionals in the 1960s. Similarly, antiseptics and vaccination were first developed in China centuries ago. Moreover, "The Compendium of Materia Medica" which describes the classification of botanical was written by a Chinese Li Shizhen in 1596 about 200 years earlier than that written by Carolus Linnaeus (1707-1778) in Europe [5].

The healing of the body in TCM is based on the body's vital forces known as "Qi". According to "Qi" concept the body has two types of forces, the "active" and the "passive" which flow through channels in the body and connect different organs, tissues, cells, nerves and veins etc. When these two forces are balance the body is healthy. The disproportion in these forces causes unhealthy conditions. A TCM practitioner diagnoses the source of unbalanced condition and the specific channel involved in that particular condition. He then treats the unhealthy condition by re-activating and balancing among different organs, cell, tissue, nerves and veins etc., by stimulating these channels. The TCM uses different methods for stimulating these channels, either by physical therapy and or herbal medicines. In Chinese herbal formulation, combination of different herbs is used to alleviate the function and or vibration of the nearby organs [6]. Today the image of Traditional Chinese Medicine (TCM) is quite controversial. While some people choose to trust the practitioners of TCM and claim to be healed by it, others see it as a traditional or cultural practice based on pseudoscience, consider its practices as a sham, or even magic [7]. Myriads of tests and experiments have been carried out in an effort to find out how such practices such as acupuncture works, or how herbal tea eliminates various illness symptoms. However, scientists struggled to find a right way to test TCM's efficacy [8]. The demand of Chinese medicines is increasing in west day by day. However, acceptance, scepticism and debate in the use of Chinese medicines have been observed. It can be said that TCM is a globalized body of knowledge and practices that is practice in many countries of the world including Germany, France, Italy and the United States etc. Candelise in her research article "Chinese Medicine Outside of China" describes the complete encounter between Chinese Medical Practices and Conventional Medicine in France and Italy. In last decade the complementary medicines industry was worth 1.5-2.5 billion US dollars [9].

2. TRADITIONAL CHINESE MEDICINE (TCM): CLINICAL TREATMENT

Traditional Chinese Medicine (TCM) is commonly used in more than 140 countries for the control and treatment of many lethal diseases [10]. Various TCM approaches are used to solve many health related problems. The conventional use of TCM have very poor efficacy for many diseases. Hence, proper clinical trials are vital to improve its efficacy and biosafety against specific diseases [11]. Many trials have been conducted to check scientific evidence of various vital TCM [12, 13].

In early clinical trials, maximum enzyme-reducing and hepatoprotective activity of an important TCM herb *i.e. Schisandra chinensis* (Turcz.) Baill was reported [14]. After this discovery, many important secondary metabolites were isolated and were used against Hepatitis B (HB)[14]. Since the end of 1980 many animal liver injury model experiments were conducted by the Chinese Academy of Medical Sciences and recorded positive hepatoprotective and other biological activities of key compound (Bicyclol) [15]. The bicyclol gave strong antifibrotic and hepatoprotective effects in liver injury rats and mice model experiments. It also demonstrated strong positive affect against hepatitis in 2.2.15 cell line and duck model experiments [16]. In chronic HB patient the Bicyclol decrease HB virus replication by increasing the concentration of serum alanine aminotransferase and by minimizing the level of aspartate aminotransferase [17]. This potent drug was approved in China since 2004 for the control and treatment of chronic HB disease [17]. Similarly, another important drug *i.e.* Taxol was approved for the treatment of cancer [18]. The TCM showed positive correlation with many disease with no or minimal adverse effect [19]. Only minimal adverse effects were reported for TCM against type II diabetes indicating certain advantages in the prevention of type II diabetes [20]. The TCM can be used with other western medicine. For example TCM showed synergistic affect with insulin and used for the treatment of gestational diabetes [21].

To improve the precision and ease to access the information of clinical trials, trial registration is being required by the International Committee of Medical Journal Editor [22]. Many institutes have developed trial registries, and ClinicalTrials.gov which is freely available to anyone. It is one of the biggest registries containing approximately 200,000 clinical trials from 174 different countries including many trials on TCM [23]. Chen et al., [24] examined 1,270 TCM trials in ClinicalTrials.gov from October 2000 to September 2015. Maximum trials 970 (1270) were found for treatment purposes followed by 168 and 96 trails for prevention and other purposes. Maximum 691 (54.4 %) trials were acupuncture; while rest 454 (35.8 %) were herbal medicines. They also recorded 55.7 % small studies enrolled < 100 subjects. USA was found the second (28.3%) after China (41.5 %), which conducted more trials on TCM. Only 50 trial (8.7 %) results were reported on ClinicalTrials.gov. In addition the disease specific TCM trials were almost similar from year 2010-15. For acupuncture trials maximum trials (18.1 %) were studied for musculoskeletal system and connective tissue. While for herbal medicine trials, maximum trials (16.6 % and 15.7 %) were tested for neoplasms and other circulatory system diseases. For cite wise information, maximum trials (52.8 %) were conducted in Asia-Pacific region followed by North America (28 %) and Europe (15.4 %). A similar study was conducted by Zhang et al. [25] to check the clinical trials of TCM against Chronic hepatitis B (CHB). They summarized the results of randomized controlled clinical trials (RCTs) of TCM during 1998-2008. Their findings envisaged the effectiveness of TCM in a separate dose or in combination with other interferon or lamivudine (IFN/LAM). Their findings showed that TCM gave positive effect as that of IFN or LAM. In addition, it increase liver function and increase antiviral activity of IFN and LAM. It also helps to maintain normal serum ALT level. They also noted that many clinical trial based study published didn't include data of adverse effect. The outcome measurement is important to check the efficacy of TCM. A total of 22 outcomes have been reported in previous study. For example, a systematic review of 35 trials investigated the efficacy of TCM on chronic obstructive pulmonary diseases [12]. One other comprehensive study reported 11 key outcomes for the improvement of the post-stroke function [26]. The correct outcomes measure is important for any clinical trial [27]. Some of the common diseases treated through the TCM are indicated in Table 1.

Table 1. TCM herbs for common diseases

S. No.	Condition / Disease /	TCM Treatment	Reference
1	Atopic dermatitis	Scutellaria baicalensis, Glycyrrhiza uralensis,, Corydalis yanhusuo, Platycodon grandiflorum	48
2	Allergic rhinitis	Platycodon grandiflorum, Angelica dahurica, Fritillaria chrrhosa, Xanthium sibiricum	48
3	Virus infection	Forsythia, Folium isatidis, Scutellaria baicalensis	49
4	Parasitic infection	Betel nut, Omphalia, Artemisia annua	50
5	Cervical spondylosis	Pueraria thunbergiana, Paeonia lactiflora, Zingiber officinale, Cinnamomum cassi, Ephedra equisetina, Glycyrrhiza gkabr	51
6	Alzheimer Disease	Panax ginseng	52
7	Parkinson disease, Cardiovascular and Coronary Heart diseases	Ginko biloba	53, 54
8	Rheumatoid arthritis	Codonopsis Radix, Atractylodis macrocephalae, Salviae miltiorrhizae	55

3. TRADITIONAL CHINESE MEDICINE (TCM): EDUCATION AND HEALTH TOURISM

The Chinese medical education system has been undergoing state-mandated reform since the turn of the millennium, and with greater momentum since 2008 [28]. The health care system and medical education has been affected by these developments in which both biomedicine and traditional medicine are together delivered and administered at each level. The vital place of plurality in the health care system of Chinese is specified by the State Council's 2015 instructions on health care development, which specifies that the Chinese state will support 15 % public hospitals will subsidize by 2020 are reserved for traditional medicines. The distinctiveness of this dual-track system has been reported by many studies [29]. However, few studies reported that in clinical practice doctors that are trained in biomedicine used regularly traditional medical.

Over the past 60 years the use of TCM has increased under state administration, with medical universities, professional status and hospital systems along with the "Western medicine." Comparison of teaching TCM in Western medical schools (or biomedical) in China with the Complementary and Alternative Medicine (CAM) treatment in medical schools in U.S. shows more dissimilarities. The American Medical Association suggested integrating elective CAM curriculum in medical schools in 1997, while individual schools are free to choose the level and makeup of requirements for course [30]. The Ministry of Education in China specifies that as part of mandatory coursework medical programs of 5 years includes training in traditional medicine. Traditional Chinese medicine is considered an important aspect of a biomedical education than CAM in the U.S. Over ten years ago, a survey done in China indicates that students in biomedicine universities obtain training in traditional Chinese medicine in two semesters, accounting to over 200 hours of informative experience [31]. Across institutions how the distribution of these hours differ and how such coursework has been gained is still need to be investigated, this study tries to fill this part of the gap.

A Survey was done by Fan et al., [32] on 60 post-graduate students, 33 undergraduate's and18 clinicians. The survey consists of open-ended and forced-choice questions and evaluating professional and personal experiences regarding TCM. Mixed quantitative and qualitative measures were utilized to study trends in open-ended survey reactions. Their findings showed that undergraduate students (67 %), post-graduate students (60 %) and clinicians (89 %) have great experienced of TCM treatments personally. Traditional Chinese medicine is recommended by the majority of all three groups to patients. In case of extra professional experience,

Fig. 1. A pharmacy in a traditional-medicine hospital in Shijiazhuang dispenses medications. Photo credits: Muhammad Ovais (Chinese Academy of Sciences) (2019).

respondents showed an overall positive attitude with TCM; however, their professional experience was mixed with TCM. The various types of TCM for a diverse range of indications the professional and extraprofessional experiences of students and clinicians show the constant clinical presence of TCM. They also envisaged the significance of more training in TCM applying, particularly on clinical level, and imminent difficulties that must be overwhelmed in implementing clinical training developments [33]. Some of the countries which had already established strict regulations regarding the TCM are indicated in Table 2.

4. BELT AND ROAD INITIATIVE BOOSTS TCM

The initiative of BRI was presented in 2013 by Chinese president Xi Jinping. The initiative has brought an economic revolution in the BRI countries by investing in the joint trading to develop infrastructure and further stimulate investment in trade, health and medicine. Almost 90 countries which add one third of global GDP have committed to join the BRI programme [34, 35]. Under this programme, China has signed deals of worth 5 trillion USD to augment trade volume in the BRI countries. Least developed countries

Table 2. Regulations in different countries about TCM

S. No.	Condition / Disease /	TCM Treatment	Reference
1	United States	Exists	56
2	Russia	Exists	56
3	Vietnam	Exists	56
4	Australia	Exists	56
5	Europe • Portugal • Austria, Bulgaria, Estonia, Hungary, Romania, Serbia, Slovenia, Switzerland, UK (Regulated treatment but profession is not regulated) • Other European countries	• Exists • Regulation for treatment exists but not for profession • No regulations	http://cam-regulation.org/en/maps

got the opportunity to develop their infrastructure to improve connectivity with neighbour countries and actively participate in the global trade [36]. In addition to infrastructure development, these countries are improving in the development of science-technology, education standard, innovation transfer and development of their own resources. Though BRI is basically an economic project, yet it has considerably contributed to the global heath development in collaboration with World Health Organization. In a BRI high level meeting, director general of WHO commented that the BRI project is a dire need for the united efforts to ensure fundamental needs including infrastructure, human resources, access to medicine throughout the world [37]. Thus the Health Silk Road, part of the BRI project is a significant effort in promoting the combined effort of BRI countries for the prevention of communicable diseases, improvement in health polices, medical training, TCM, health education and disaster management system [38].

The BRI initiative has boosted the international recognition of Chinese traditional treasure 'Traditional Chinese Medicine" (TCM) [39]. In May 2018, the state administration for TCM reported that 57 TCM projects under the BRI programme have been initiated in various countries including United Arab Emirates, France, Germany and Poland. In Spain, under the umbrella of European TCM development and promotion centre, a signature project will be initiated including TCM training-education centre, health clinic and trade centre. Moreover, a master degree programme will be initiated with the support of Beijing University of Chinese Medicine, University of Barcelona and Universitat of Pompeu Fabra. Up till now, about twenty nine countries have established laws and regulations for the use of TCM and eighteen countries had given a legal status to acupuncture in their health care system. For instance, Portugal as a first European country has approved laws to open 4 years bachelor's degree programme in acupuncture in 2017 in Polytechnic Institute of Setubal (IPS). Further, IPS has signed an MOU with Tianjin University of TCM to allow students to study for one extra year in Tianjin University of TCM for their bachelor degree [40, 41]. The Portuguese government has also approved laws about offering TCM bachelor's degrees in other institutions.

5. TCM VITAL AREA OF HEALTH AND TRADE COOPERATION BETWEEN CHINA AND WORLD

Traditional Chinese medicine (TCM) is among the best preserved influential forms of traditional medical system [43] which symbolizes the Chinese culture and heritage. TCM is getting popular with passing days as the world faces numerous issues with conventional medicines like antibiotic resistance. Thus, traditional medicines are considered as a window of opportunity to cope with deadly diseases. Noble prize to Tu Youyou, for discovery of Artemisinin from Artemisia [44] is an excellent example to demonstrate the power of TCM and other forms of traditional practices. TCM has much strength as compared to western system. The impact of the TCM is now valued domestically but also internationally. Reports suggest that there are 12,807 TCM resources in China distributed as medicinal plants (11,146), medicinal animals (1581), and medicinal minerals (80). About 600 Chinese medicinal materials are common in use, in which near 400 plant and animal species are artificially cultured. In addition, a statistical analysis of 320 commonly used plant medicinal materials indicates that the total resources storage has reached approximately 8.5 million ton [45]. BRI possess a great potential towards the internationalization of the TCM system. In a holistic view, traditional Chinese medicines has many advantages as compared to the conventional medicines. The focus of the TCM is holistic that is curing both the root cause and symptoms of the disease. Synthesis of chemical entities is a hard and time consuming process often takes decades in development. The developmental cost of synthetic drugs is very high, and moreover, side effects are one of the major concerns. The development of new synthetic drugs is slow paced and very few satisfy the commercial and economical aspects. On the other hand, traditional systems are in place from thousands of years, whether it be TCM, Greek Medicines or Ayurveda Medicines, using natural resources for healing purposes with minimal or no side effects. Different pharma products finds its bases in plant medicines. Some classic examples are anticancer drugs from *Catharanthus roseus* [42], antiviral drug from *Silybum marianum* [46] and antimalarial drug from *Artemisia annua* [47]. Therefore, TCM should be among the priority areas

regarding health corridor among the BRI countries. It will provide extensive opportunities to develop health sector among the partnering countries and execute potential research and development projects regarding natural medicines.

5.1 A Flagship Project of BRI, China–Pakistan Economic Corridor (CPEC) Pakistan is Intended to Rapidly Modernize Pakistan.

CPEC is a multibillion dollar project not only intended to improve the connectivity among different regions but also holds the potential of massive socio-economical uplift, well fare, technological cooperation and mobilization in different fields. CPEC can have significant impact on the aggravating economy of Pakistan. With reference to traditional medicines, Pakistan has a medicinal flora which can be easily exported for revenue generation. CPEC will significantly increase the market outreach for Pakistani made herbal products across different regions of the world. Through scientific and technological cooperation, Pakistani herbal industries can transformed into modern research based traditional medicine industries. Chinese experience in TCM and their internationalisation can be a motivation for the local herbal manufacturing companies in Pakistan. Chinese herbal plants, R & D, pharmaceutical equipment, management and marketing, export strategies and transportation of herbals have continued intermittent development and are rapidly expanding. Pakistan can seize on CPEC opportunity to develop its local herbal industry and devise strategies for effective utilisation of the local manufacturing of herbal medicine. Convergence of TCM with Pakistani folkloric practices will indeed result in fascinating advancement of the health care sector in the region.

Provision of a holistic quality care is considered an important area of cooperation under CPEC, which will be incomplete without considering TCM. TCM is one of the greatest gifts of Chinese culture to the mankind in which natural resources and products are used to cure various diseases and infections. With the health corridor now materializing in the form of CPEC, TCM creates massive opportunities for the extensive cooperation between Pakistan-China and other countries part of the initiative. Traditional Chinese Medicine is one of the areas that can be used in creating opportunities for improving the health care in general and creating evidence based natural solutions to major health issues. Herbal medicine industry is growing in an expeditious manner and still 80 % of the world population relies on herbal medicine [42]. Folkloric and natural medicines have deep foundations in Pakistan, in the form of "Greek Medicines"/ "Tibb-e-Unani", and "Prophetic Medicines" / "Tibb-e-Nabwi" [42]. The amalgamation of TCM practices with traditional medicine practices in the region and rich biodiversity of Pakistan can led to massive leaps in evidence based natural medicines Moreover, it would further create opportunities for entrepreneurial setups dealing ultimately transforming in the big herbal industries. This will further enable this region to capture a handsome portion in the gigantic international market for herbal medicines. For the local manufacturers it will provide easy trade routes to different regions to export their indigenously developed herbal medicine around the world. Pakistan and China have already embarked into joint ventures in different sectors however; the operation in TCM and herbal sector is scarce. CPEC intend to create a link between herb research centres, academics, teaching institutes, universities, researchers and experts for the capacity-building Pakistan in the herbal sector. The exchange of knowledge and information would further pave ways for setting-up of a joint department of herbal and traditional medicine, traditional medicine hospitals through which the public will have access advanced herbal treatment, and additional employment opportunities will be created.

6. RECOMMENDATIONS BY AUTHORS

- Consumer confidence on alternative systems can be a driving force for fostering the future of these traditional systems. Increase in the consumer confidence is subject to the scientific approaches and evidence based research. Therefore, it's imperative to undertake measures which entice traditional medicine manufacturers for adopting scientific techniques, processes and procedures. The umbrella of CPEC and BRI can have significant impact in bringing latest technologies for standardization and quality assurance of traditional medicines. Practitioners of alternative medicines need to adapt a

scientific approach for conducting herb-drug interaction studies. It will further provide new avenues for conducting research, innovation and development, ultimately transforming the alternative medicine industries leading to acceptability and consumer confidence.

- Recognition of traditional medical systems and bringing them to the mainstream necessitates the need of mass awareness. A strong advocacy for promoting the use of traditional medicines is required to stimulate the policy makers, stake holders and other relevant parties for accepting traditional medicines in mainstream.
- Proper use of herbal medicines in the general public and consumers may be promoted. The narrative of traditional medicines, always being safe is misleading. Recognition of Drug interactions. The widespread belief that whole herbs formulations are harmless is not correct. Concurrent use of herbs with modern medicine may mimic, magnify, or oppose the effect of drugs. The apparently harmless garlic can interact with some modern drugs and cause serious interaction like bleeding when taken with low dose aspirin and Warfarin etc.
- Herbal practitioners, scientists and industrialists in Pakistan should take benefit from the opportunity given by BRI and CPEC. Under the umbrella of CPEC, entrepreneurial setups in traditional systems and partnerships can be nurtured which will have a long lasting positive impact.
- It is recommended to have a joint centre of excellence dedicated to preserving the fascinating heritage of alternative medical systems like Traditional Chinese Medicine, Eastern Medicine and others. Building shared and common resources can be pivotal to harvest the benefits of such traditional medicinal systems. Shared repositories and databases can be created for documentation of medicinal systems, herbals, their uses with open access to all. Like convergence of economic interests through CPEC among BRI countries, the traditional medical systems needs to converge together to fulfil the health vacuum in this region. In this regard, joint hospitals offering treatments through TCM and Eastern Medicine can play significant role.
- With the expected rapid industrial activities under CPEC and BRI, one can assume a rapid rise for the demand and supply of crude materials used in the manufacturing of traditional medicines. Most of these medicines are made from the unique and rare herbs and plant material. Strategies and policies are required to ensure the growth of herbal industries but not at the cost of disturbing the natural balance. Therefore, all policies must be based on the No Net Loss (NNL) for preserving the natural habitat as well as preventing significant loss in the number of species for preventing their extinction.
- Policies with reference to traditional drugs regulations and licencing are very crucial. A vibrant regulatory body with holistic capacity for 360 degrees evaluation of the products is required.
- Incentivising the traditional medicine industry, promoting educational programs related to traditional medicines can have a positive impact on the future of TCM, and other forms of traditional systems in BRI regions. There is also need to educate common people on the subject matter as the TCM spreads in BRI countries.

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