OVERVIEW

Historical Background

National Ayurveda Research and Training Center (NARTC), under the Ministry of Health and Population, Government of Nepal is an autonomous body primarily working in the field of Ayurveda research, healthcare and capacity building. NARTC was established as a national level apex body for effective development and promotion of Ayurveda as a model institute for advancing research, training and patient care by Ayurveda system of medicine. The NARTC project began since the month of November 2003 when the Government of Nepal proposed to the Government of the People's Republic of China for the unequivocal necessity of NARTC project in Nepal. Under the joint efforts and friendly cooperation between the nations, both the nations officially agreed to implement NARTC project on August 16, 2004. The Government of the People's Republic of China and the Ministry of Health and Population of the Government of Nepal authorized China Jiangxi Cooperation for International and Technical Cooperation to build the project of NARTC on September 21, 2008. The project was commenced on February 20, 2009 and the Government of the People's Republic of China handed NARTC over to Government of Nepal on April 3, 2011. For further enhancement of NARTC, the Government of the People's Republic of China aided medical and training equipment with the value of RMB Yuan 15,400,000/- (RMB Yuan Fifteen Million and Four Hundred Thousands Only) in accordance with the provision of the letters exchanged on August 18 and August 24, 2014 between the nations. The Government of the People's Republic of China officially handed over the equipment to the Government of Nepal on May 11, 2016. In addition to this, Chinese

technical team also supported installment of equipment at NARTC. Under Development Committee Act, NARTC was in operation from February 12, 2012 till July 16, 2019.

Location

NARTC is located just outside the premises of Tribhuvan University, Kirtipur with an area of 19482.4 m^2 (30 *Ropanies*). The organization has three major blocks namely Research Hospital block, Research block and Training block. Another four small buildings are designated as animal house, generator and water equipment house, and waste management and cafeteria buildings. Building construction occupied 34563 m^2 (17.7%) area of the territory of NARTC.

Vision

- The major vision envisaged for the NARTC is to promote research and training activities for contributing towards the globalization of Ayurveda system of Medicine and for providing evidence based quality Ayurveda health services to people.

Mission

- Support and conduct ethical research in Ayurveda.
- Train and provide skilled manpower in field of Ayurveda.
- Implement evidence based research in treatment to the patient care activities to validate Ayurvedic treatment.
- Advocate and disseminate knowledge of Ayurveda research for the welfare of mankind.

Objectives

- To protect, preserve, develop and commercially utilize medicinal and aromatic plants (MAPs) and natural resources to meet the WTO (World Trade Organization), TRIP S (Trade-Related Aspects of Intellectual Property Rights) and IPRs (Intellectual Property Rights).
- To build linkages with different institutions and entrepreneurs inside and outside the country.
- To develop appropriate technology and transfer of technology and skill up to the grass root level for the conservation, cultivation and capitalization of medicinal plants.
- To develop inventive and innovative steps for development of drugs and clinical practices.
- To initiate and promote research and good practices applied in production, manufacture and supply of Ayurveda and herbal drugs.
- To provide necessary training for the employees of government and non-government of Ayurveda institution and its related human resources.
- To identify measures for enhancing the capacity of developing programs in farming and processing of Medicinal and Aromatic plants.
- To conduct national and international meetings/seminars/conferences.

Strategies

- In order to perform institutional roles and undertake necessary activities following strategies goals have been visualized:

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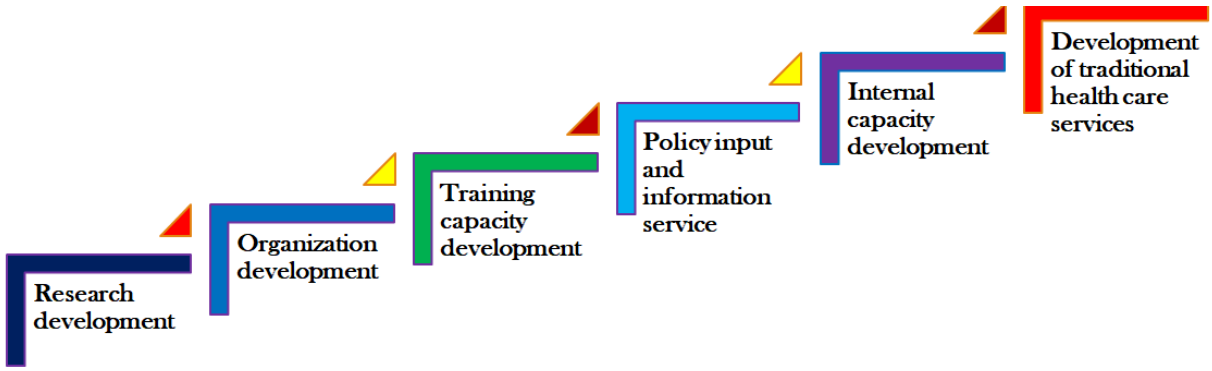

I: Research

1. Contribution in life-science research based on Ayurveda principles
2. Delivering modern research techniques based on Ayurveda guidelines.
3. Delivering information about research, training and health care service.
4. Generating revised evidences for Ayurveda healthcare system in Nepal

II: Training

1. Delivering and improving training services.
2. Developing researches, trainers and experts.
3. Developing capacity building and strengthening professional related governmental and non-government organizations.

III: Health Care Services

1. Strengthening Ayurveda healthcare system of Nepal.
2. Popularizing Ayurveda system of medicine.

3. Contributing in evidence based health care services.

IV: Internal Capacity Development

1. Capacity building within the organization in various related sectors for better output of the organization as a whole.

2. Developing internal organizational and management capacity through various training and capacity building sessions within and outside the institution

V: Policy Input and Information Services

1. Maintain collaboration with existing stake holders, while promoting linkages with new institutions with similar goals and objectives.

Organization structure

The organizational structure of NARTC has been set up under Development Board Act of Government of Nepal. It is an autonomous institution under Ministry of Health and Population, Nepal. Development Committee of the center delivers policy, approves programs and reviews progress. The Executive Director of NARTC is responsible for overall management of the organization. The heads of the NARTC divisions are responsible for the day to day functioning of their respective divisions. The organization set up of NARTC is depicted under three divisions:

- **Research Hospital Division**
- **Research Division**
- **Plan, Training and Administration Division.**

Organogram

******Design the chart as picture below******

Provincial Branches of NARTC

Among the seven provinces of Nepal, NARTC already has established its branches in Province 1, Madesh Province and Gandaki Province.

Below is the list of branches currently in service.

- **Province 1, Laukahi, Sunsari**
- **Province 2, Bardibas, Mahottari**
- **Province 3, Nuwakot, Belkotgadhi**
- **Province 4, Siranchowk, Gorkha**

The Institutional Review Committee (IRC)

The Institutional Review Committee (IRC) of NARTC reviews proposed studies to ensure that it follows internationally and locally accepted ethical guidelines. They monitor studies once they have begun and, where relevant, take part in follow-up action and surveillance after the end of the research. The committee has the authority to approve, reject or stop study or require modification to research protocols.

Objective:

- To promote high ethical standards in research for health.

Functions

- To set policies or offer opinions on ongoing ethical issues in research
- To review international ethical standards governing research involving human participants, as well as by local law in many jurisdictions
- To review required laws of the country in which the research is being sponsored, even if it is not required by the host country's own laws

- To review to publish the results of their investigation, as most medical journals will not publish the results of research that has not received the approval of a research ethics committee
- To protect potential participants in the research
- To take into account potential risks and benefits for the community in which the research will be carried out

Sub-committees

NARTC has set up its experts committee for research, training and health care services. Highly experienced academic professionals are the members of sub-committee. The sub-committee members provide guidance and valuable suggestion in executing and implementing activities or programs in respective services. The three sub-committees at NARTC are:

- Research sub-committee
- Training sub-committee
- Hospital management sub-committee

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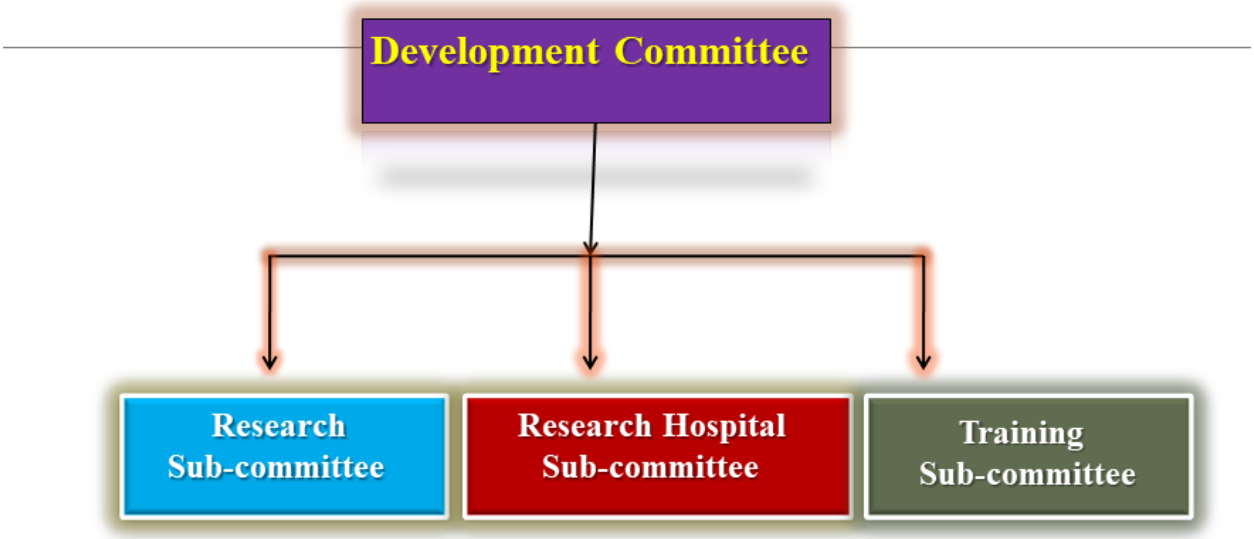

Research sub-committee

Research sub-committee is organized to review intramural as well as collaborative research projects of NARTC. The committee critically reviews the research projects and recommends the research proposal for grant. The committee also plays vital role in disseminating information of the research result.

Objective

- To prioritize research area, evaluate research proposals and recommend for grant.

Function

- To prioritize research area
- To select topics for research
- To review technical proposal
- To evaluate proposal
- To recommend for grant

- To disseminate the research
- To finalize the research report
- To recommend publication of the research report

Training sub-committee

This sub-committee overviews all the training activities/programs conducted by NARTC. It prioritizes training subjects, develops curriculum and recommends for conduction of training.

Objective

- To prioritize training area, develops training curriculum and recommends implementing training.

Function

- To prioritize training area
- To select topics for training
- To develop training curriculum
- To recommend conducting training
- To advise for further improvement

Hospital management sub-committee

This sub-committee generates advice for managing hospital smoothly. It prioritizes health care services and fixes fee. It also suggests recruiting required human resources installing of instruments, monitoring and evaluation of health care services.

Objective

- To manage health care services, fixes fee and recommends further projects for health care services

Function

- To manage health care services
- To fix fee of the services
- To contribute in clinical research
- To recommend health care projects
- To advise for further improvement

Program and Services

I. Research Hospital

Research based health services in OPD/IPDs are:

- Kaya Chikitsa (Internal Medicine)
- Shalya (Surgery)
- Shalakya (ENT)
- Stri-Prasuti (Gynaecological and Obstetrics)
- Arbuda (Oncology)
- Danta (Dental)

Special Services:

- Panchakarma Therapy
- Ksharsutra
- Acupuncture

- Therapeutic Yoga
- Physiotherapy

Other services are:

- Clinical Pathology
- Ultrasonography
- X-ray
- CT scan
- EEG/ECG
- Endoscopy/colonoscopy
- Pharmacy

Current services in the laboratory

Biochemistry	Serology	Hematology	Others
Glucose	ASO Titre	CBC	Stool R/M
Uric acid	CRP (Qualitative)	ESR	Urine R/M
RFT	CRP (Quantitative)	CT/BT	Occult Blood
LFT	RA Factor	Reticulocyte count	
Lipid Profile	Widal Test	Kala azar	
Calcium	HIV 1& 2	Malaria	
Phosphorus	HBs Ag	HbA1C	
Total Protein	HCV	D-Dimer	
Serum albumin	VDRL		
	H. Pylori		

	TPHA		
	Blood Grouping		

II. Research section

Currently running as well as perspective researches in NARTC are based on following fundamentals.

- Clinical research primarily focused on non-communicable disease
- Drug Research
- Drug Standardization
- Pre-clinical Research / Pharmacological Research
- Medicinal Plant Research (Medico-Ethno Botanical Research, Pharmacognosy),
- Literary Research & Documentation
- Toxicology
- Nutrition

Research units in NARTC:

Microbiology laboratory

- Evaluation of microbial contamination in drug formulations.
- Study activities of herbal plants against pathogenic micro-organisms.
- Antimicrobial activity of indigenous plants of Nepal
- Isolation of enzyme from bacterial culture.
- Preservation of bacterial strains.

- Tests for specified micro-organisms i.e. *Escherichia coli, Staphylococcus aureus, Bacillus subtilis, Klebsiella pneumoniae,* etc.
- Finding role of Ayurveda drugs in the treatment of various diseases

Molecular biology laboratory

- Isolation of plant DNA for digital library such as DNA barcoding.
- Preparation of DNA samples using PCR tools for further studies including sequencing.
- Isolation and characterization of bacterial DNA
- Molecular diagnosis of diseases

Immunology laboratory

- Quantification of hormonal changes during animal model trials of various drugs
- Quantification and analysis of toxic substances
- Disease diagnosis using ELISA
- Disease diagnosis using CLIA
- In-vitro essay for toxicity of various compounds

Instrumental analysis laboratory

- Chromatographic techniques for separation and analysis of samples.
- Separation of plant product on the basis of polarity, volatility and so on
- Standardization of Ayurveda medicines
- Determination of Dissolution, hardness, total ash, alcohol, extractive values, water soluble extractive, moisture content etc.

- Determination of Refractive index, Specific gravity, Determination of pH values, Determination of melting range and boiling range.
- Determination of viscosity, Determination of saponification, iodine & acid values
- Determination of peroxide value, Determination of alcohol content

Animal/Clinical trials

- Animal breeding, intervention and study of effects of various drugs.
- Development of histopathological laboratory.
- Development and evaluation of a novel drug delivery system of medicinal plant in Nepal
- Development of clinical trials of related diseases

Phytochemical Analysis Laboratory

- Hot and cold extraction of plant parts using various solvents.
- Concentration of extracts using rotary evaporator.
- Quantitative phytochemical analysis of Proteins & Amino acids, Carbohydrates, Glycosides, Phytosterols & Triterpenoids, Tannins, Flavanoids, Saponins, Alkaloids, and Fats & Fixed oils
- Determination of Total Ash, Determination of Acid Insoluble Ash, Determination of Water Soluble Ash, Determination of Sulphated Ash
- Determination of Alcohol Soluble Extractive, Determination of Water Soluble Extractive
- Determination of Ether Soluble Extractive (Fixed Oil Content)
- Determination of Moisture Content (Loss on Drying)
- Determination of Volatile Oil in Drugs

Plant tissue culture

- Micro-propagation of medicinal plants of high commercial values.
- Growing endangered medicinal plants of Nepal in a controlled environment.
- Production of medicinal plants for commercial benefits as well as for research.

III. Training section

- Training on skilled development
- Strengthen and capacity building of respective professionals
- Improving capabilities of individual working at different levels of Ayurveda

IV. Other facilities

- **Herbarium/ Crude Drug's Library**

NARTC has developed its crude drug museum with more than 300 crude drugs. Crude drugs and medicinal plant species are collected from various parts of Nepal in appropriate time of the year and from appropriate altitudes. They are stored at dry and clean environment for further research and sampling purposes.

- **Library**

The library is an air-conditioned room with wi-fi internet connection. The library has books and photocopy references on ayurveda, allopathy, sanskrit, science etc. Rare and reference books are

also kept separately. The library has started to collect research thesis by NARTC. Automation of library work is in progress and in near future it will digitalize.

- **Conference and Training Hall**

NARTC has an air-conditioned training hall with a capacity of 50, built with all facilities for conducting training activities. Training hall of NARTC is in good amenity. This is being used for training activities and seminars.

Collaboration and linkage

NARTC is mainly research and training based institution. It has linked up with national and international research and training organizations.

Some of the national and international organizations are:

- Nepal Health Research Council, Ramshah Path, Kathmandu
- Ayurveda Campus & Teaching Hospital, Kirtipur, Kathmandu
- B.P. Koirala Cancer Hospital, Bharatpur, Chitwan
- China Academy of Chinese Medical Sciences, Beijing, China
- Hebei Research Institute, Hebei, China

Highlights of Work Progress in FY 2078/79

A. HEALTH CARE ACTIVITIES

Research Hospital

NARTC has its own research hospital with a bed capacity of 31 for indoor patient department (IPD) and provides outdoor patient department (OPD) services as well. The main objective of the hospital is to provide evidence based medical care through Ayurveda system of medicine to the patients. It prioritizes clinical research along with patient care through its OPD, IPD, panchakarma therapy, ksharsutra, acupuncture, therapeutic yoga, physiotherapy, clinical pathology, ultrasonography, X-ray, CT scan, EEG/ECG, endoscopy/colonoscopy and pharmacy. Special treatment facilities are available for anorectal disorders, cancers, rheumatology and endocrinology. Registration is free in the hospital for senior citizens and patients who participate in intramural clinical research. Most of the medicines dispensed for intramural clinical research are manufactured in the pharmacy of NARTC and are provided for the patients free of cost. Health care services are 50 percent discount for the residents of Kirtipur Municipality and senior citizens.

Outpatient Department (OPD)

In the fiscal year 2078/79, a total of 10367 patients visited the NARTC including 3,985 new cases and 4,212 follow up cases, out of which 3483 patients attended Kayachikitsa OPD whereas 1620 patients attended Shalya OPD respectively (Table 1).

Table 1 Frequency of patients visited NARTC OPDs in the year 2078/79

Service	Frequency
Total patients/cases	10367
New cases	3985
Follow up cases	4212
Renew cases	2156
Kaya Chikitsa (I, II & VI) OPD	3483
Shalya OPD	1620

The Figure 1 represents the frequency of patients who received the available services at NARTC in the year 2078/79. Among the services, the maximum patients i.e. 2,956 received Pathology laboratory services, followed by acupuncture unit with 2,406 patients. Similarly, 1557 patients were enrolled in Physiotherapy unit, 931 patients in Radiology & imaging unit, 855 patients in Panchakarma unit while 739 patients were in Dental unit.

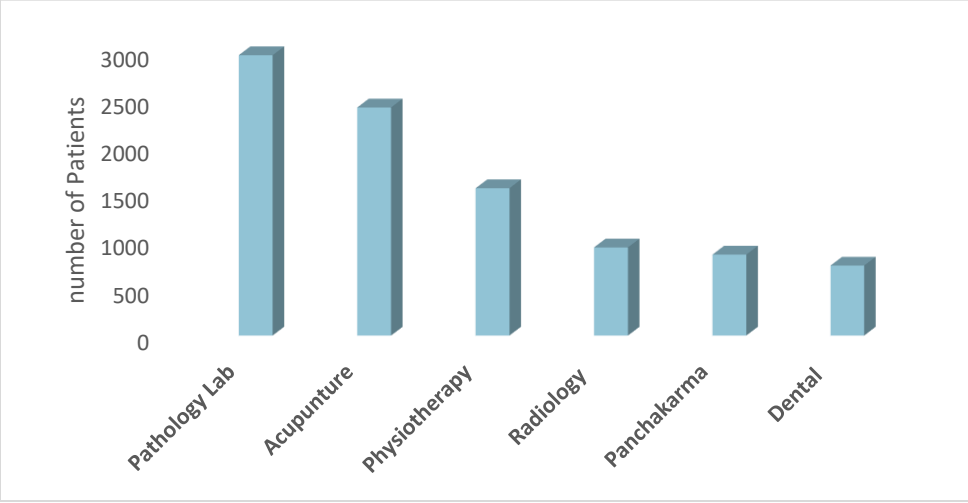

Figure 1 Frequency of patients receiving different services at NARTC in fiscal year 2078/79

Pathological Services

In the year 2078/79, we received 2,956 routine test samples in the Pathology laboratory of NARTC consisting 1739 biochemistry tests, 1,404 hematology, 1,219 serological and 311 parasitology tests (Figure 2). The received test samples include blood, urine and stool specimens.

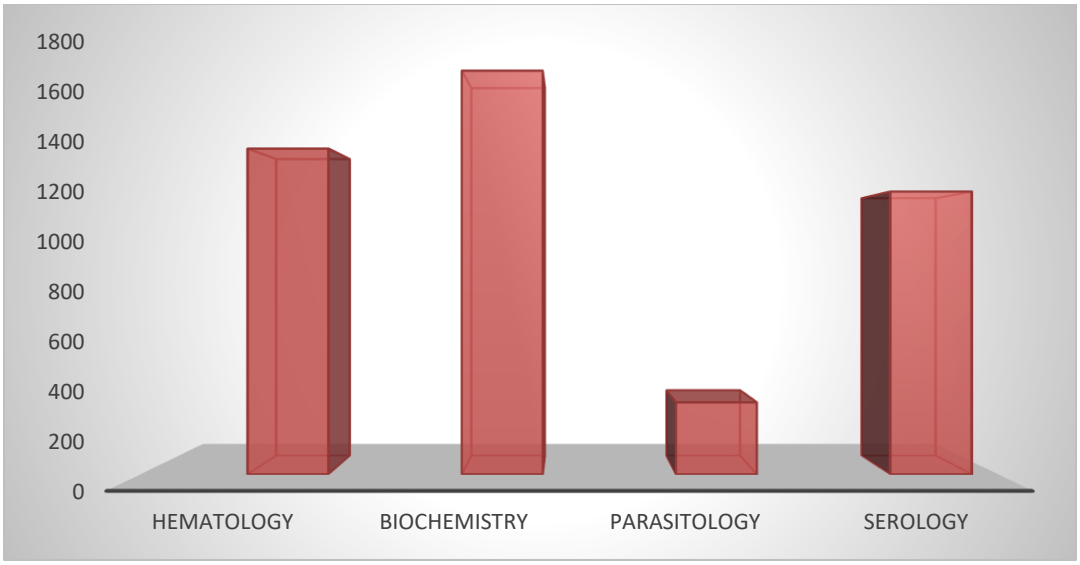

Figure 2 Distribution of routine tests in Pathology laboratory, NARTC in the year 2078/79

Inpatient Department (IPD)

The total bed capacity for IPD is 31 beds. During the year under report, the total patients treated in IPD were 161 out of which 78 were operated cases. As compared to previous year 2077/78, bed occupancy increased from 22 to 161 accounting above 13% increment.

B. RESEARCH ACTIVITIES

Clinical Research

i. Efficacy and safety of Trikgud as an add-on medicine in uncontrolled type 2 diabetes mellitus (T2DM) patients with metformin monotherapy: A randomized controlled trial

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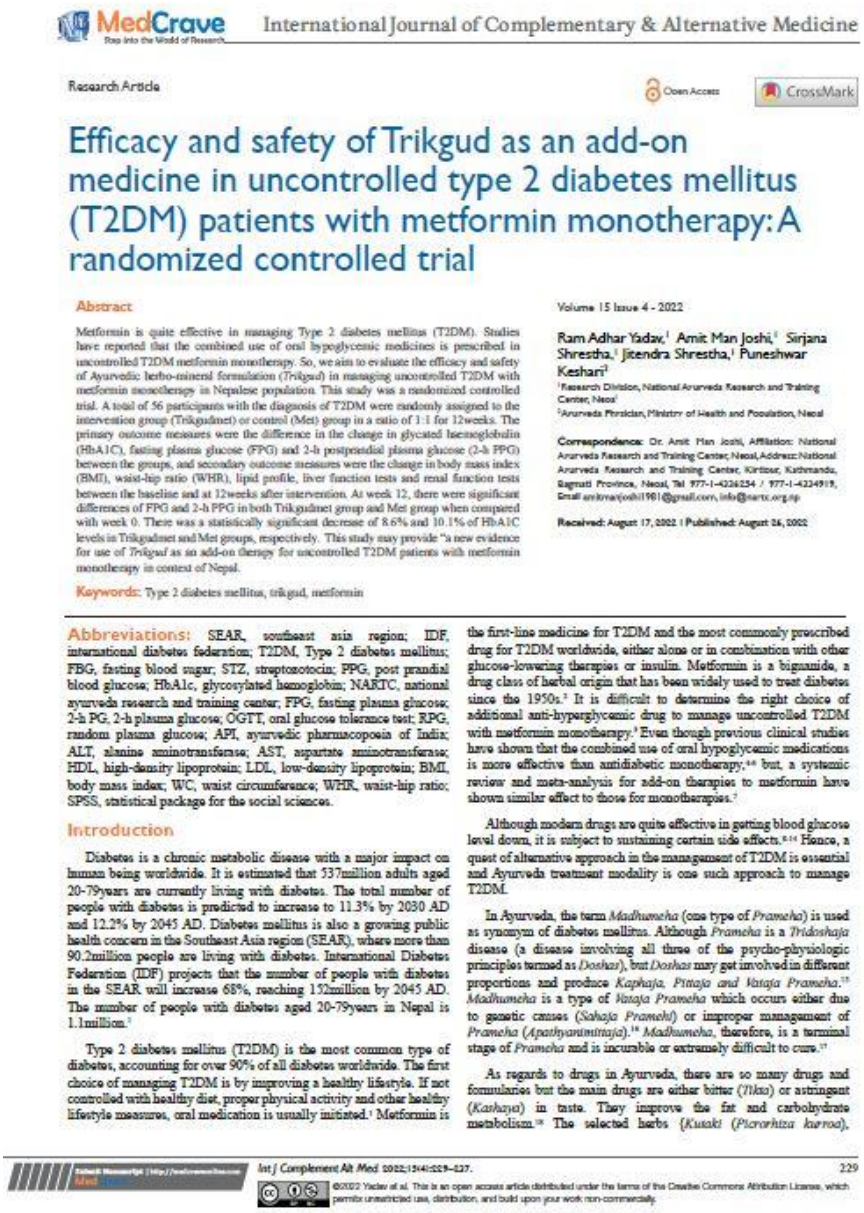

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Efficacy and safety of Trikgud as an add-on medicine in uncontrolled type 2 diabetes mellitus (T2DM) patients with metformin monotherapy: A randomized controlled trial

Abstract

Metformin is quite effective in managing Type 2 diabetes mellitus (T2DM). Studies have reported that the combined use of oral hypoglycemic medicines is prescribed in uncontrolled T2DM metformin monotherapy. So, we aim to evaluate the efficacy and safety of Ayurvedic herbo-mineral formulation (*Trikgud*) in managing uncontrolled T2DM with metformin monotherapy in Nepalese population. This study was a randomized controlled trial. A total of 56 participants with the diagnosis of T2DM were randomly assigned to the intervention group (Trikgudmet) or control (Met) group in a ratio of 1:1 for 12weeks. The primary outcome measures were the difference in the change in glycated haemoglobin (HbA1C), fasting plasma glucose (FPG) and 2-h postprandial plasma glucose (2-h PPG) between the groups, and secondary outcome measures were the change in body mass index (BMI), waist-hip ratio (WHR), lipid profile, liver function tests and renal function tests between the baseline and at 12weeks after intervention. At week 12, there were significant differences of FPG and 2-h PPG in both Trikgudmet group and Met group when compared with week 0. There was a statistically significant decrease of 8.6% and 10.1% of HbA1C levels in Trikgudmet and Met groups, respectively. This study may provide "a new evidence for use of *Trikgud* as an add-on therapy for uncontrolled T2DM patients with metformin monotherapy in context of Nepal.

Keywords: Type 2 diabetes mellitus, trikgud, metformin

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Abbreviations: SEAR, southeast asia region; IDF, international diabetes federation; T2DM, Type 2 diabetes mellitus; FBG, fasting blood sugar; STZ, streptozotocin; PPG, post prandial blood glucose; HbA1c, glycosylated hemoglobin; NARTC, national ayurveda research and training center; FPG, fasting plasma glucose; 2-h PG, 2-h plasma glucose; OGTT, oral glucose tolerance test; RPG, random plasma glucose; API, ayurvedic pharmacopoeia of India; ALT, alanine aminotransferase; AST, aspartate aminotransferase; HDL, high-density lipoprotein; LDL, low-density lipoprotein; BMI, body mass index; WC, waist circumference; WHR, waist-hip ratio; SPSS, statistical package for the social sciences.

Introduction

Diabetes is a chronic metabolic disease with a major impact on human being worldwide. It is estimated that 537million adults aged 20-79years are currently living with diabetes. The total number of people with diabetes is predicted to increase to 11.3% by 2030 AD and 12.2% by 2045 AD. Diabetes mellitus is also a growing public health concern in the Southeast Asia region (SEAR), where more than 90.2million people are living with diabetes. International Diabetes Federation (IDF) projects that the number of people with diabetes in the SEAR will increase 68%, reaching 152million by 2045 AD. The number of people with diabetes aged 20-79years in Nepal is 1.1million.[1]

Type 2 diabetes mellitus (T2DM) is the most common type of diabetes, accounting for over 90% of all diabetes worldwide. The first choice of managing T2DM is by improving a healthy lifestyle. If not controlled with healthy diet, proper physical activity and other healthy lifestyle measures, oral medication is usually initiated.[1] Metformin is the first-line medicine for T2DM and the most commonly prescribed drug for T2DM worldwide, either alone or in combination with other glucose-lowering therapies or insulin. Metformin is a biguanide, a drug class of herbal origin that has been widely used to treat diabetes since the 1950s.[2] It is difficult to determine the right choice of additional anti-hyperglycemic drug to manage uncontrolled T2DM with metformin monotherapy.[3] Even though previous clinical studies have shown that the combined use of oral hypoglycemic medications is more effective than antidiabetic monotherapy,[4-6] but, a systemic review and meta-analysis for add-on therapies to metformin have shown similar effect to those for monotherapies.[7]

Although modern drugs are quite effective in getting blood glucose level down, it is subject to sustaining certain side effects.[8-14] Hence, a quest of alternative approach in the management of T2DM is essential and Ayurveda treatment modality is one such approach to manage T2DM.

In Ayurveda, the term *Madhumeha* (one type of *Prameha*) is used as synonym of diabetes mellitus. Although *Prameha* is a *Tridoshaja* disease (a disease involving all three of the psycho-physiologic principles termed as *Doshas*), but *Doshas* may get involved in different proportions and produce *Kaphaja, Pittaja and Vataja Prameha*.[15] *Madhumeha* is a type of *Vataja Prameha* which occurs either due to genetic causes (*Sahaja Prameh*) or improper management of *Prameha* (*Apathyanimittaja*).[16] *Madhumeha*, therefore, is a terminal stage of *Prameha* and is incurable or extremely difficult to cure.[17]

As regards to drugs in Ayurveda, there are so many drugs and formularies but the main drugs are either bitter (*Tikta*) or astringent (*Kashaya*) in taste. They improve the fat and carbohydrate metabolism.[18] The selected herbs (*Kutaki* (*Picrorhiza kurroa*),

ii. Efficacy of Ayurvedic polyherbal formulation in Aamvata with reference to Rheumatoid Arthritis.

Abstract

Background: Traditionally, Ayurvedic medicines have been used for the treatment of rheumatoid arthritis (RA) with reference to Aamvata. However, safety and efficacy of ayurvedic medicines have not been evaluated. Therefore, the present study was carried out to evaluate the efficacy and safety of Ayurvedic herbal formulation (Mixture of Sunthi, Guduchi, Guggul and Eranda) in patients with RA.

Methods: Twenty three patients with RA were screened at National Ayurvedic Research and Training Center (NARTC), Kirtipur, Nepal. Patients took Ayurvedic herbal formulation (AHF) twice a day for three months with lukewarm water before meal. The follow up of patients was carried out every two weeks. The primary efficacy end point was based on American College of Rheumatology (ACR) 20 response. Safety assessments were renal

function test (RFT) and liver function test (LFT).

Results: There was no statistically significant difference between before and after intervention in disease parameters of tender joint counts, swollen joint counts, stiffness joint counts, RA factor, CRP, RFT and LFT except for pain assessment score, visual analogue score and ESR. Conclusion: Our findings did not suggest the efficacy of AHF in RA. However, due to small sample size, non-randomization and lack of a control group as study limitations, further studies need to be done to confirm these findings.

Medicinal Plant Research

i. An Assessment of Phytochemical, Antioxidant, Antimicrobial properties of medicinally important herbs of Nepal.

Research Summary

Antioxidant activity:

A majority of antioxidants naturally present in foods occur in phenolic structures and especially in flavonoid structures. Free radical scavenging activities of solutions of the plant extracts and synthetic antioxidant substances were prepared in methanol at concentrations of 50, 100 and 200 μg/mL., which is based on the principle of scavenging the DPPH (1,1-diphenyl-2-picrylhydrazyl) radical. DPPH was added to the solutions prepared with plant extracts and standard antioxidant substances and stirred. Each mixture was kept in the dark for 30 min and the absorbance was measured at 517 nm against a blank.

Antimicrobial assay:

Antibacterial test by agar well diffusion method Antibacterial activity tests measure the ability of an antibacterial agent to inhibit bacterial growth in vitro. In agar well diffusion method, small cups (wells) were made by cork-borer in the petri-plate containing the required medium, already inoculated by test organism. The diluted extract is added to the well. After incubation, the diameter of the zones of complete inhibition was measured (including the diameter of the disc) and recorded it in millimeters. The measurements were done with a ruler on the undersurface of the plate without opening the lid.

Objectives:

General:

- An Assessment of Antioxidant, antimicrobial activity of five folklore medicinal plants used by traditional healers in Nepal

Specific:

- Sample collection, identification and preparation of folklore medicinal plants
- Study of antioxidant activity *in vitro*
- Study of antimicrobial activity

Rationale:

- No systematized scientific proof justification about the uses of folklore medicinal plant.
- Even though Nepal is rich in possibly high potent medicinal plant, proper study and characterization has not been done in adequate level.

ii. Antidiabetic activity of aqueous extract of *Jasminum nudiflorum* formulation in alloxan induced diabetic Sprague Dawley rats

Objectives:

General:

- To evaluate the hypoglycemic activity of *Jasminum nudiflorum* leaves in alloxan induced diabetic rats.

Specific:

- To collect, identify and authenticate *Jasminum nudiflorum*

- To determine Physiochemical and estimation of active constituents of *Jasminum nudiflorum* leaves
- To evaluate the hypoglycemic activity of alcoholic and aqueous extract of *Jasminum nudiflorum* in diabetes induced rats.
- To assess the abnormal lipid metabolism in diabetes induced rats.

Rationale:

- Modern understanding of phytochemical is limited due to which various medicinal plants are yet to be researched. Researches on plant help us on development and identification of metabolites that could be used for prevention and treatment of diseases.

Induction of experimental diabetes with Alloxan:

Rats to be induced with diabetes are fasted overnight for 12 hours. Solution of alloxan monohydrate of dose 90 mg/kg was injected intraperitoneal. After injecting alloxan solution intraperitonally they were fed 5 ml of 10% glucose solution to overcome death resulted from compensatory hypoglycemic shock. Animals with random glucose level greater than 140mg/dl after 24-48 hours of administration of alloxan monohydrate were considered to be diabetic and study was continued.

Blood Sample collection and analysis:

Fast blood glucose level of rat was determined before the start of the experiment as baseline level. Then the Blood samples were collected at 0, 1,3,7,14 and 21 days from tail vein puncture till the end of the study. On day 21 bloods was collected by cardiac puncture under mild

anesthesia (isoflurane) from overnight fasted rat. Clear supernatant serum was prepared in eppendorf tube for analysis of fasting blood glucose level(by GOD-POD method).

Results:

Table 2 Effects of ethanolic extract of *Jasminum nudiflorum* on the Blood glucose level

Group	Treatment (mg/kg of Body weight)	Blood Glucose Level (mg/dl) Mean ± SD					
		Day 1	Day 3	Day 5	Day 7	Day 14	Day 21
I	Normal Control	114.4±3.8	108.6±4.3	106.2±4.3	114±9.1	112.8±7.7	113.8±8.9
II	Diabetic Control	111±6.4	158±8.2	189±12.4	173.2±12.5	146±14.1	123.8±10.8
III	Diabetic + metformin (15microgram/kg)	105.2±3.7	129±14.5	136.8±8.7	120±7	104.4±8.3	77.2±3.7
IV	Diabetic + Eth. Extract (200mg/kg)	110.4±8.3	150±2.9	180.4±3.9	165±3.1	142.6±7.6	120±9.1
V	Diabetic + Eth. Extract (300mg/kg)	112.8±7.5	148.4±4.6	168.4±3.8	155.6±4.5	135.8±6.97	118.4±3.5
VI	Diabetic + Eth. Extract (500mg/kg)	115.8±17.1	141.4±11.2	149.4±4.9	147.2±5	128.8±8.1	105.2±.1

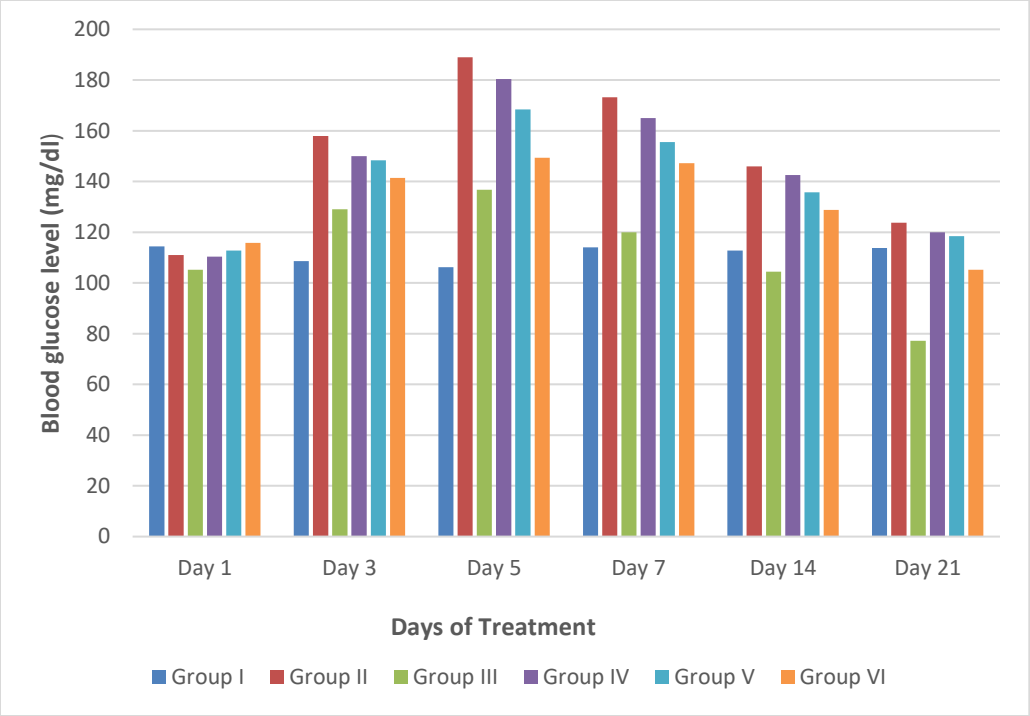

Figure 3 Effect of different treatments on blood glucose in alloxan induced diabetic rats

iii. Study of In Vitro Anti-cancer activity of alcoholic extract of *Nigella sativa* seeds on HeLa cell lines

Abstract:

Background:

Nigella sativa is a native plant Nepal growing at elevations of 1500–2500 m. The seeds of *N. sativa* are considered as an important nutritional flavoring agents and natural remedies for various aliments for hundreds of years in ancient systems of medicines like Ayurveda, Chinese and Arabic medicines. Different active components such as thymoquinone, thymol, thymohydroquinone, nigellicine and nigellidine have been isolated from *N. sativa*. Oils, various extracts and active components are identified to be effective in immune stimulation, anti-inflammation, antihypertensive, antimicrobial, antiparasitic, hypoglycemic, antiasthamatic, antioxidant and anticancer effects. The present work is aimed at investigating the anticancer potential of ethanol extracts of *N. sativa* seed against normal and HeLa cells.

Methods:

The dried seeds were first grinded and the fine powder then treated with ethanol. The bioactive compounds from *N. sativa* seeds were extracted using Soxhlet apparatus. The study was performed at different concentrations such as 50µg/ml, 50µg/ml, 100µg/ml, 200µg/ml and 400µg/ml. MTT assay was carried to determine the cell viability and IC_{50} values. IC_{50} values for HeLa and normal cell lines were compared against standard cisplatin.

Results:

Results of the MTT assay showed that ethanolic seeds extract caused a dose dependent decrease in the HeLa cell viability (IC_{50}: 375. 2 µg/ml). In contrast, other lower concentrations did not show any significant activity whereas standard Cisplatin showed effective result against HeLa cell line with $IC_{50:}$ 25 µg/ml.

Conclusions:

This ability of the extract proved the anti-cancer property of *Nigella sativa* seeds extract and the present study enables further studies on the isolation and characterization of an anticancer molecule from the seeds of *N. sativa.*

Epidemiological Research

i. The prevalence of Type 2 Diabetes mellitus in 4 different areas of Nepal

Abstract

Although there are different epidemiological studies for the prevalence of Type 2 diabetes mellitus (T2DM) in Nepal, simultaneous conduction of studies in different areas of Nepal is relevantly poor in context of Nepal. The patients often avoid regular clinical examination in small town areas of Nepal leading to late diagnosis and treatment of T2DM. So, we aim to design the study among the people visiting health camp at different areas in Nepal. In the present study, out of 2143 participants, the overall prevalence of T2DM was found to be 4.2 %. Among the diagnosed T2DM participants, the mean age was 51.2 years with higher frequency in male (80%) than female (20%). In the present study, T2DM participants were more likely to be obese. This study may contribute to epidemiological knowledge about the prevalence of T2DM among Nepalese population.

C. TRAINING ACTIVITIES

Training and Certificate Distribution

NARTC stepped forward to achieve its training programs set up for fiscal year 2078-079. NARTC had conducted 8 training programs and some awareness programs for the year. A total of 123 Ayurveda Doctors and 65 Ayurveda Paramedics and Health workers were trained and around 300 general public were given awareness programs regarding the importance of Ayurveda this year. The training programs were organized on different dates within a year. Because of the ongoing pandemic situation, we were unable to bring resource person physically so this year we conducted some training through webinar where participants were physically present in our center by maintaining physical distance in the classroom and resource person trained the participants through webinar. The following were the training activities given below:

1. Event I: Training and Workshop on Agnikarma

NARTC conducted the training for 3 days from 4th of Ashoj to 6th of Ashoj, 2078 BS where twenty-six Ayurveda Dpctorss were trained during the workshop. The participants were selected from 7 provinces of Nepal. Dr. Mahesh V. Sanghai, Senior Ayurvedic Consultant Pioneer in Kshar-sootra , Agnikarma , Rakta-mokshan .Propogator & Master of hands on training programme and Prof. Dr. Yubus G. Solanki, M.S. Ayu.(Mumbai), R. A. Podar Medical College (Ayu.), Worli, Mumbai, India were the chief resource person during the training program. The closing ceremony featured with presence of Prof. Dr. Dhanik Lal Bharkher, Former Chairman, NARTC and Dr. Ram Adhar Yadav, Executive Director, NARTC.

2. Event II: Training and Workshop on Agnikarma

NARTC conducted the training for 3 days from 7th of Ashoj to 9th of Ashoj, 2078 BS where twenty-six Ayurveda Dpctorss were trained during the workshop. The participants were selected from 7 provinces of Nepal. Dr. Mahesh V. Sanghai, Senior Ayurvedic Consultant Pioneer in Kshar-sootra , Agnikarma , Rakta-mokshan .Propogator & Master of hands on training programme and Prof. Dr. Yubus G. Solanki, M.S. Ayu.(Mumbai), R. A. Podar Medical College (Ayu.), Worli, Mumbai, India were the chief resource person during the training program. The closing ceremony featured with presence of Prof. Dr. Dhanik Lal Bharkher, Former Chairman, NARTC, Dr. Shivmangal Prasad, Campus Chief; Ayurveda Campus, Kirtipur and Dr. Ram Adhar Yadav, Executive Director, NARTC.

3. Event II: Training on Clinical Application of Marma Chikitsa

NARTC conducted the training for 3 days from 11th to 13th Kartik 2078 BS, where twenty-three Ayurveda Doctors were trained during the workshop. The participants were selected from 7 provinces of Nepal. Dr Shishir Prasad M.S. (Ay). Associate Professor P.G. Dept of Shalya Tantra Uttarkhand Ayurved University Member Expert Committee on Marma Chikitsa CCRAS, Govt of India was the chief resource person during the training program . The closing ceremony featured with the presence of Hon'ble Mr. Rajan KC, Member of Constituent Assembly, Prof. Dr. Dhanik Lal Bharkher, Former Chairman, NARTC, and Dr. Ram Adhar Yadav, Executive Director, NARTC, including resource person of the training.

4. Event IV: Basic Training and Workshop on Marma Therapy

NARTC conducted the training on Marma Chikitsa for 3 days from 14th to 16th Mangsir, 2078 BS where eighteen Ayurveda Paramedics were trained during the workshop. The participants were selected from 7 provinces of Nepal. Dr. Sunil Kumar Joshi, MS (Shayla Tantra), Professor and Head of the Department (Gurukul Kangari State Ayurvedic College, Haridwa) was the chief resource person throughout the training period through webinar. The closing ceremony featured with presence of Prof. Dr. Dhanik Lal Bharkher, Former Chairman, NARTC and Dr. Ram Adhar Yadav, Executive Director, NARTC.

5. Event V: Basic Training on Panchakarma Chikitsa and clinical application of Marma Therapy

NARTC conducted the training on Basic Training on Panchakarma Chikitsa and clinical application of Marma Therapy for 3 days from 8th to 10th Chaitra, 2078 BS where twenty Ayurveda Paramedics were trained during the workshop. The participants were selected from 7 provinces of Nepal. Dr. Sunil Kumar Joshi, MS (Shayla Tantra), Professor and Head of the Department (Gurukul Kangari State Ayurvedic College, Haridwa) was the chief resource person throughout the training period through webinar. The closing ceremony featured with presence of Prof. Dr. Dhanik Lal Bharkher, Former Chairman, NARTC, Prof. Dr. Dev Bahadur Roka, Chairman NARTC and Dr. Ram Adhar Yadav, Executive Director, NARTC.

6. Event VI: Basic Training on Panchakarma Chikitsa and clinical application of Marma Therapy

NARTC conducted the training on Basic Training on Panchakarma Chikitsa and clinical application of Marma Therapy for 3 days from 22nd to 2th Chaitra, 2078 BS where twenty Ayurveda Paramedics were trained during the workshop. The participants were selected from 7 provinces of Nepal. Dr. Sunil Kumar Joshi, MS (Shayla Tantra), Professor and Head of the Department (Gurukul Kangari State Ayurvedic College, Haridwa) was the chief resource person throughout the training period through webinar. The closing ceremony featured with presence of Prof. Dr. Dhanik Lal Bharkher, Former Chairman, NARTC, Prof. Dr. Dev Bahadur Roka, Chairman, NARTC and Dr. Ram Adhar Yadav, Executive Director, NARTC.

7. Event VII: Training and Workshop on Basti Therapy

NARTC conducted the Training and Workshop on Basti Therapy for 3 days from 5th to 7th Baishakh, 2079 BS where forty-one Ayurveda Doctors were trained during the workshop. The participants were selected from 7 provinces of Nepal. Facilitator were Vaidya Bhattad Satish, B.A.M.S., Ph.D, FIIM, Shreeji Ayurvedic Panchakarma Hospital and Research center (Est.1992) Shamdwar , Namdeo Mandir Road, Shrirampur and Dr. Ramdas Avhad; Am Rastriya Ayurveda Guru (Rastriya Ayurveda Vidhyapeeth, Dhanwantari Ayurveda Hospital, Kopargaon Maharastra, India. The closing ceremony featured with presence Prof. Dr. Dhanik Lal Bharkher, Former Chairman, NARTC, Dr. Ram Adhar Yadav, Executive Director, NARTC and Prof. Dr. Dev Bahadur Roka, Chairman, NARTC.

8. Event VIII: Basic Training and Workshop on Clinical Application of Kshar-Sutra Chikitsa

NARTC conducted the Basic Training and Workshop on Clinical Application of Kshar-Sutra Chikitsa for 3 days from 8th to 10th Jestha, 2079 BS where twenty-two Ayurveda Paramedics were trained during the workshop. The participants were selected from 7 provinces of Nepal. The closing ceremony featured with presence Prof. Dr. Dhanik Lal Bharkher, Chairman, Nepal Ayurveda Medical Council and Dr. Ram Adhar Yadav, Executive Director, NARTC.

9. Event IX: Stress Management Program

NARTC conducted one-day Stress Management Program for Executive on 4th of Ashad, 2079 BS where twenty-one executives form Office of the Prime Minister & Council of Ministers had participated in the program. The program featured with presence Prof. Dr. Dhanik Lal Bharkher, Former Chairman, NARTC and Dr. Ram Adhar Yadav, Executive Director, NARTC.

D. HEALTH CAMP

The new branch office of NARTC was inaugurated under the chairmanship of Mr. Rajendra Raman Khanal, Mayor of Belkotgadhi, Prof. Dr. Dhanik Lal Bharkher, Chairman, Nepal Ayurveda Medical Council and Dr. Ram Adhar Yadav, Executive Director, NARTC. Free Ayurveda Health camp and drug distribution program was also conducted in newly inaugurated branch in Belkotgadhi, Nuwakot district on 29 Falgun, 2077 B.S. Several hundred patients got free health checkup and free ayurvedic medicines in the health camp.

COVID-19 OUTBREAK

Background

As a part of the National healthcare system, NARTC has always been responsible towards any healthcare challenges that the country may face. NARTC began tracing COVID-19 patients via telephone calls among residents of Kirtipur Municipality with the help of Female Health Volunteers during Nepal's first lock-down period (11th Chaitra, 2077 B.S.). At the same time, the expert team of NARTC was continuously preparing for the possible management strategies of COVID-19 through Ayurvedic principles. Under the chairmanship of Executive Director, Ram Adhar Yadav, a thirteen membered committee was formed with Dr. Jitendra Shrestha as the coordinator to manage COVID-19 patients. Meanwhile, Ministry of Health and Population, Government of Nepal declared NARTC as an Isolation Center for COVID-19 patients on 25th Ashad, 2077 B.S. With this, NARTC faced both opportunity and challenges to serve the country in crisis during the very first wave of COVID-19 outbreak in Nepal.

Establishment of COVID isolation center

After the declaration of NARTC as a national isolation center for COVID-19 patients, a three storied building belonging to Institute of Medicine, Tribhuvan University just outside the premises of NARTC was provided for an isolation center of COVID-19 patients. The journey all started with managing beds, toilets and other logistics from the early stage. Due to time constraint and overwhelmingly increasing number of COVID-19 positive patients, isolation center had to be ready within 2 days. The isolation center was then initiated with a capacity of 200 beds for managing COVID-19 patients. NARTC is forever indebted towards various

organizations namely, Covid-19 Control and Management Center (CCMC), Department of Health Services (DoHS): Logistic Department, Environment and Public Health Organization (ENPHO), Oxford Committee for Famine Relief (OXFAM), Kirti Ayurveda Medisales, Kathmandu Municipality, Kathmandu Upatyaka Khanepani Limited (KUKL) and Kirtipur Sub-municipality.

****Insert picture from case management ppt slide*****

Management of COVID-19 cases

Interventional therapy for mild and moderate cases during the first and second wave of COVID-19 outbreak in Nepal

The expert team of NARTC took an initiative to formulate an innovative herbo-mineral formulation for the management of COVID-19 patients. The herbo-mineral formulation composed of aqueous extract of *Tinospora cordifolia*, powdered form of *Zingiber officinale*, *Piper longum*, *Piper nigrum* and *Abhrak Bhasma*. The drug proved to be very effective in reducing progression of severity of the symptoms as well as reducing the number of hospital stay for the COVID-19 patients. Along with this, immune booster herbal tea was given twice a day; COVID-19 patients were advised to gargle with guava leaves decoction and salt 2-3 times per day. Preferably ayurveda medicines followed by allopathic medicines in emergency case were given for the symptomatic management of COVID-19.

In addition to the intervention therapy, following therapies were also advised to the COVID-patients:

- YOGA
- PRANAYAMA
- MUSIC THERAPY
- LAUGHING YOGA

Dietary regimens

For dietary regimens, expert dieticians and nutritionists were consulted and proper nutritious diet was given to each admitted COVID-19 patients during the hospital stay. In addition to this, a teaspoonful of turmeric with one glass of lukewarm milk was given to each COVID-19 patients at bedtime.

As for relieving mental stress to COVID-19 patients, various entertaining serials were also shown in projector display at NARTC isolation center for COVID-19 each day at evening time.

Sample collection for COVID-19 identification at NARTC

Meanwhile, the pathology laboratory collected 894 nasopharyngeal or oropharyngeal oral swabs for COVID-19 identification varying the age below 10 to above 70 years. Out of 894 participants, 561 were males and 333 were females with the male-female ratio (M:F) is 1.68:1. The maximum participants involved and the incidence of the disease was observed in the age group 21 to 30 years while low in age group below 10 years (Table 2).

Table 5: Age and gender wise distribution of Oral swab collection

Age Group	**PCR Positive**		**PCR Negative**	
	Male	**Female**	**Male**	**Female**
<10	0	2	11	16
11-20	10	8	38	25
21-30	52	27	175	125
31-40	51	23	120	57
41-50	22	6	41	23
51-60	10	2	20	9
61-70	3	1	3	6
>70	2	2	3	1
Total	**150**	**71**	**411**	**262**

Among the collected swab specimens 221 were identified positive for COVID-19 consisting150 males and 71 females whereas remaining 673 specimens were found to be negative accounting 411 males and 262 females (Figure 3). The overall incidence of the disease was found to be 32%.

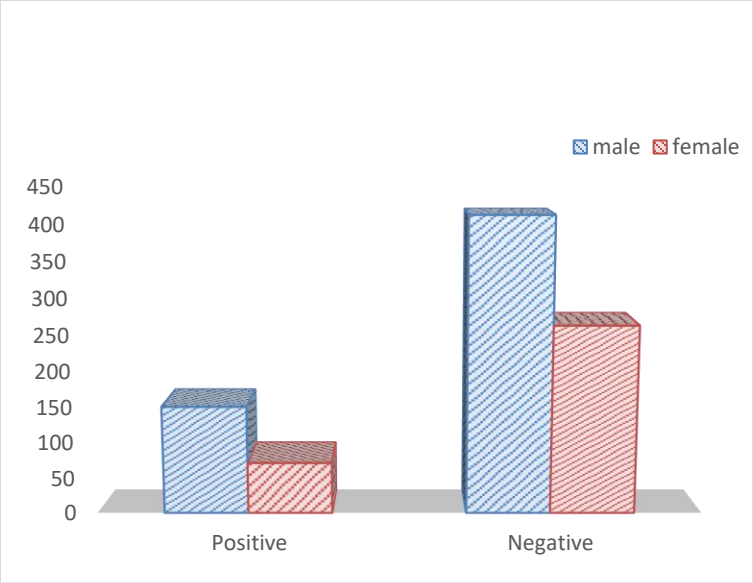

Figure 3: Age and gender wise distribution of Oral swabs collected in Pathology laboratory, NARTC

Preparedness of High Dependency Units (HDUs) at NARTC

Sadly Nepal, following India, entered a second wave of COVID-19 outbreak since early April. The shocking rise in the number of Covid-19 infections was straining Nepal's fragile healthcare system during the second wave. NARTC isolation center quickly responded with prepared 30 bedded High Dependency Units (HDU) at Research Hospital Building of NARTC during the second wave of COVID-19. Several hundreds of COVID-19 patients with moderate and severe symptoms were cared at HDUs of NARTC. Expert team of NARTC developed integrated treatment protocol for the COVID-19 patients. Integrated treatment protocol included classical *Ayurvedic Rasa Ausadhi* and national guideline of COVID-19 management protocol.

Annex 1: Training and Workshop on Clinical Application of Marma Chikitsa

Date 2077.10.05 to 2077.10.07

S.N.	Name
1	Bijay Kumar Singh
2	Raj Kumar Mahato
3	Dhirendra Singh
4	Jayanarayan Yadav
5	Ramchabila Yadav
6	Sanjay Kumar Yadav
7	Hari Kishor Ray
8	Bhupendra Prasad Yadav
9	Pramod Kumar Yadav
10	Narayan Wosti
11	Ramkrishna Paudel
12	Devraj Lamichhane
13	Bimal Kumar Shrestha
14	Archana Kumari Jha
15	Ganga Tamang
16	Khemraj Devkota

17	Santalal Sahani
18	Arbind Marbaita
19	Sanjib Prasad Thakur
20	Shyam Mishra
21	Mukesh Jha
22	Pramodh Yadav
23	Gayatri Aryal
24	Indu Joshi
25	Ragini Jha

Annex 2: Basic Training and Workshop on Pancakarma Chikitsa

Date 2077.10.26 to 2077.10.28

S.N.	Name
1	Shanta KC
2	Sirjana Marasaini
3	Shyam Kumar Rayamajhi
4	Bishowraj Ghimire
5	Ganga Devi Sharma
6	Sarita Adhikari Devkota
7	Laxmi Prasad Sharma
8	Kamal Bikram Paudel
9	Ram Biswas Ray
10	Nagendra Prasad Yadav
11	Ashok Kumar Yadav
12	Arbind Kumar Das
13	Shyam Sundar Thakur
14	Sonelal Sah
15	Pramodh Kumar Swarnakar
16	Rakesh Kumar Yadav
17	Krishna Kumar Yadav
18	Gokul Parajuli
19	Manoj Kumar Yadav

20	Ganesh Yadav
21	Shyam Kumar Mishra
22	Mukesh Jha
23	Pramodh Kumar Sah
24	Gayatri Aryal
25	Indu Joshi
26	Ragini Jha

Annex 3: Basic Training and Workshop on Marma and Yoga Therapy

Date 2077.11.24 to 2077.11.26

S.N	Name
1	Amar Bhuwan Chaudhary
2	Uddhav Bhattarai
3	Anil Kumar Thakur
4	Bal Keshar Pandit
5	Chandreshwor Prasad Baith
6	Parmananda Pathak
7	Ram Chabila Yadav
8	Bindi Yadav
9	Chunchun Prasad Yadav
10	Bharat Ray
11	Januka Dhungana
12	Nanda Kishor Ray Yadav
13	Prakash Sapkota
14	Hari Aryal
15	Sarita Adhikari Devkota
16	Sashi Koirala
17	Lokraj Pandey
18	Rajkumar Das

19	Dinbandu Mishra
20	Kisunlal Mahato
21	Shankar Prasad Sah
22	Kalpana Paudel
23	Hum Kumari Gyawali
24	Laxman Prasad Raut
25	Ram Sewak Yadav
26	Manoj Mahato
27	Tarni Prasad Chaudhary

Annex 4: Basic Training and Workshop on Kshar-Sutra Chikitsa

Date 2077.12.26 to 2077.12.28

S.N	Name
1	Suchi Kumari Sah
2	Jibaddha Kumar Panjiyar
3	Surendra Prasad Yadav
4	Sushil Kumar Mishra
5	Bhola Prasad Sah
6	Dwarika Sah
7	Babita Dhakal
8	Arbind Kumar Ray
9	Gobinda Prasad Gaire
10	Debendra Thakur
11	Gita Chaudhary
12	Rangalal Mahato

13	Sudhir Kumar Chaudhary
14	Radha Krishna Ray
15	Laxmi Narayan Mishra
16	Januka Bhandari Gaire
17	Indu Koirala