Sudan University for Science and Technology

UNESCO ISESCO Chair for Woman in Science and Technology

Quarterly Scientific Bulletin

July – September 2017

Editorial Board:

♦ Prof Rashid Ahmed Al Hussein, Vice Chancellor of Sudan University of Science & Technology, Chairman of the Board of UNESCO-ISESCO Chair for Women on Science and Technology

♦ Dr. Al ShafaAbdelgadir, Director of UNESCO -ISESCO Chair for Women on Science and Technology

♦ Ustaza Hind Jaffer el Awad, Program Coordinator at UNESCO-ISESCO Chair

♦ Dr. Fatima Mohamed Al Hassan, Coordinator of Projects

♦ Mohamed Faysal Mohamed Al Tayeb, Training Coordinator

Contents

Workshops:

1. Workshop on "Woman with Disability (WWD) Issues in Sudan":

1.1 "Women with Disability E-development: Minimizing the Gap":

• **Dr.AtigaYousif Elmubark** atikaa5@hotmail.comDepartment of Educational Technology, College of Education, Sudan University of Science and Technology

Abstract:

In our community women with disability face discrimination on different layers. They suffer from being isolated, under-educated and unemployed; accordingly, they face ignorance and poverty the thing which may lead to low self-steam. ICT can help those women in having access to education; break the social isolation and getting respectful jobs, thus, leading prosperous independent lives.

1.2 "Women with Disabilities and Work":

• **Aisha Al Imam**- Director of the Center for Documentation, Women & Gender Research and Peace-building- Ministry of Social Welfare

Abstract:

Disabled Persons' Right to Work

The Convention on the Rights of Disabled Persons has obliged the State Parties to recognize the right of the disabled to have work on equal footing with the rest of citizens. This right includes provision of opportunities to earn living through work of their own choice, work they freely accept.

The labor market and environment should be open to the disabled in an inclusive and accessible manner. The States Parties have to protect the right to work and strengthen it, including protecting persons injured during work. This carried out through appropriate steps, including enacting laws. These laws should include the following:

1. Prevention of discrimination against persons with disabilities in work and employment. According to article 2 of the Convention on the Rights of Persons with Disabilities, discrimination is an act aiming at weakening or depressing a person. All rights and basic freedoms arerecognized and maintained, and given to the disabled on equal footing with the others in all spheres, basic, social, cultural and civic.

Thus, discrimination covers all types of exclusion including denial of reasonable facilitation arrangements.

Actions to implement the principle of labor discrimination's prevention should include all aspects such as:

• Employment procedures like announcement and interviews.

• Review of procedures to eliminate indirect discrimination that excludes the disabled persons like the condition of physical fitness.

• Review the articles on work conditions like the salary, working hours and leaves.

• Promotion, training and other work incentives

• Safe and healthy conditions of work and prevention of harm &harassment

• As for the article 2/12 of the Transnational Constitution, 2005, nobody denied work or profession on the base of disability. Article 45 of the Constitution confirms the right of persons with disabilities in work.

• Despite these constitutional texts, many regulations hamper getting a job, including the condition of physical fitness. This means exclusion of persons with disabilities to get work in the armed forces for instance.

2. Employing of Disabled Persons in Government Jobs:

There is a statement in the Convention of Persons with Disabilities on employing disabled persons in government sector. As per article 72, persons with disabilities should find work in the public sector. It says, "States Parties have to take positive measures on the issue including positive discrimination and flexible conditions for employment".

In Sudanese legislations, the National Law on Disabled's Rights has confirms the right of the disabled to get employment. The Civil Service Law, 2007, has similar statement. It stipulates that the government assign 2 percent of jobs for the disabled, in a way that takes into consideration nature of job and type of disability.

The execution of this article has raised a hot debate on the percentage. A number of relevant questions raised. Does classification of disability depend on the quota? How can we measure the level of efficiency? When does general completions start and how do we decide on positive discrimination? What is the percentage of the disabled in the job deemed unsuitable for them?

We suggest issuing an executive statue to settle such a debate in a way that protects the rights of the disabled in government employment.

3. Employing Disabled in the Private Sector:

The Convention on the Rights of Persons with Disabilities has obliged the States Parties to encourage the employment of the disabled in the private sector, as part of integration among all business sectors.

Implementation happens through certain policies and measures that may include corrective program and incentives. For instance, companies employing the disabled given an exemption from customs and taxation.

4. Facilitation Arrangements at the Work Place:

These are appropriate and reasonable arrangements in favor of the disabled so that they enjoy their rights on equal footing with the others. According to article 2, the State Parties are obliged to take appropriate measures enabling the disabled to participate in work life on equal and complete manner.

For instance, the blind provided with computers& talking software and the deaf provided with sign language facilities.

5. Strengthening Opportunities of Self-employment:

Professional work may not be available or suitable for persons with disabilities. Thus, the Convention on Persons with Disabilities stipulates, self-employment boosted in addition to encouragement of cooperatives and private businesses. This includes microfinance programs, finance portfolio, habilitation and vocational training. The States Parties are committed to provide the disabled with vocational and technical training. The National Disabled Law stipulates that, a special training quota assigned for the disabled in coordination with the vocational training.

1.3"Sudanese Men's Attitudes towards Marrying Women with Disabilities":

• **Dr .Manal AltayibTalab Ahmed**Psychological Specialist, Alomdah Social Center,Omdurman Locality,Ministry of Social Development

Abstract:

This paper studies the attitudes of Sudanese non-disable men towards marrying a woman with disability. The paper is a summary of descriptive research conducted in the State of Khartoum

The sample of the study is composed of 107 normal menwho have no disabilities of any kind. I used the social survey methodology, which included the tools of questionnaire, interview and group discussion. Frequency tables utilized for the analysis of data and information collected, making comparison among tables wherever possible.

Providing an overview of women with disabilities' needs and sufferings, the paper focuses on marriage as a variable of great significance. It is a well-known fact that in the Sudan studies and research on women with disabilities is very rare. I based this paper on the following hypotheses:

• Sudanese men view women with disabilities as inferior wives, compared to their able counterparts.

• The families of potential husbands appose their sons' marriage from a woman with disabilities.

• Marriage from a woman with disabilities is doomed to failure, because the society has a negative attitude towards the very ideas as selection depends on shape and appearance.

The study has come up with the following results:

- The majority of the sample dismissed the possibility of marrying a woman with disabilities.
- Many families do have reservations that their sons get married to a woman with disabilities.
- The educational level plays no role in the selection of disable woman for marriage.
- Sudanese men without disabilities consider a disable woman as wife of inferior status.

1.4"Problems facing Rehabilitation Programs for Women with Disabilities"

- **Dr. Manal Mustafa Hamadelneel**-ZCR-Sudan International University-Faculty of Economic MBA program Human Resource Department. University of Medical Sciences and Technology.

2007 Diploma in Non-Governmental Organizational Management Faculty of Agriculture, Khartoum University. 1999 MSc in Extension EducationKhartoum University. 1995 Post –graduate Diploma in Adult Education Ahfad University, 1993 B.Sc in Psychology and Pre-school Kindergarten.

Abstract:

Rehabilitation programs for women with disabilities consisted of medical, psychological, social, vocational, academic and occupational components. What is the status of the Sudan in terms of providing such rehabilitation program, compared with other developing countries? What are the problems facing such programs and can we find solutions for some or all of them? The paper depends on primary sources in addition to observation and experience. We used the comparative approach due to lack of basic research on the subject in the Sudan. Problems facing rehabilitation for disabled in our country are similar to those in African and Arab countries. Lack of information, poor transparency and confused vision and social negative attitudes do have great negative impact on rehabilitating women with disabilities in the Sudan. We recommend the conduct of institutionalized and professional research on the subject as the leading force for problems solutions. We also recommend unification of the disabled institutions, establishment of networking & partnerships, rationalization of material & human resources and boosting the services of occupational therapy.

1.5"Women with Disabilities and Education"

• **Dr. Salma ATayib AliTaha** - Founder and Director General, Tayib Ali Taha-Academy for Children with Disabilities – Kosti Member, Executive-Bureau, National Union for Intellectual Disability

Abstract:

Disability is not an issue concerning one or two individuals; it is an issue concerning all sectors of society. Thus, we have pull together all possible efforts and from all sectors in order to limit its negative implications.

Our true religion urges us to adhere to equality and justice, to refrain from discrimination, to preserve dignity, and to draw a balance between rights and duties. In accordance with such good values, disability in the Sudan inserted as an issue concerning law and legislation. The goal is to go with such high values as well as with relevant universal trends.

In fact, international covenants and charters have guaranteed comprehensive rights for persons with disabilities, and urged State Parties to guarantee these rights. Women with disabilities have a secure place in these rights, because of their unique conditions.

Nonetheless, women with disabilities are persons with no big role to play in society. They face many forms of discriminations, depending on social and cultural variations in this or that society.

Education is a universal right extended to all children and youth with disabilities. Education for women with disabilities is a major challenge in fulfillment of education for all in the Sudan. This is due to the society's ignorance of women with disabilities' rights and lack of appropriate services. For sure, women with disabilities are always at the bottom of the list in terms of rights and commitments.

2. Workshop on the "Indigenous Knowledge for Native Women in Medicine, Agriculture and Climatic Change"South Kordofan (Aldalang)"

2.1Women Indigenous Knowledge in Medicine, Agriculture, and Climate Change in the State of South Kordofan.

• **Dr Tomadir El khansa** Gumaa BalalSaad -B.pharm ,MSc pharmacology , University of Medical Sciences & Technology

Lecturer of Pharmacology &Therapeutic, University of Kordofan , Faculty of Medicine &Health Sciences.

Abstract:

1. Documenting and introducing indigenous knowledge of the population in medicine.

2. Listing common illnesses and diseases in the geographical area, local treatment and medication.

3. Reviewing local and regional experiences in popular medicine and exchanging views with participants in the workshop through discussion.

4. Reviewing the opportunities of medication by herbs and medical sources.

5. Presenting effective materials in medication and showing medical plants from apharmaceutical point of view.

Introduction on Medicine

Medicine has started and developed since the beginning of humanity on earth. Some scientists describe it as old, others describe it as modern. Medicine has developed with the development of life and the renaissance of science and nations and become a highly-specialized science. Attention and care given to people's health is on the increase locally, regionally and internationally, thanks to the major progress made in human awareness and believes.

Meanwhile, humanity witnessed an increase in chronic diseases, life-threatening epidemics and injuries caused by natural disasters.

No wonder, medicine assumed a respected and effective role in society. Certificates

given by universities, research centers. Training and treatment provided at hospitals, clinics, laboratories and pharmacies. Voluntary organizations provide medical assistance and councils issue fellowships.

One writer said the first man on earth was the first doctor. This is an indication that medicine started through practice and experimentation, namely using herbs and trees. To survive and thrive, man utilized the environment in securing shelter food and medicine.

• **Dr.AbdelbagiAhmed Hamid koko**

AlobaiedUniversity

Abstract:

1. Documenting and introducing indigenous knowledge of the population in medicine.

2. Listing common illnesses and diseases in the geographical area, local treatment and medication.

3. Reviewing local and regional experiences in popular medicine and exchanging views with participants in the workshop through discussion.

4. Reviewing the opportunities of medication by herbs and medical sources.

5. Presenting effective materials in medication and showing medical plants from a pharmaceutical point of view.

Introduction on Medicine

Medicine has started and developed since the beginning of humanity on earth. Some scientists describe it as old, others describe it as modern. Medicine has developed with the development of life and the renaissance of science and nations and become a highly-specialized science. Attention and care given to people's health is on the increase locally, regionally and internationally, thanks to the major progress made in human awareness and believes.

Meanwhile, humanity witnessed an increase in chronic diseases, life-threatening epidemics and injuries caused by natural disasters.

No wonder, medicine assumed a respected and effective role in society. Certificates given by universities, research centers. Training and treatment provided at hospitals, clinics, laboratories and pharmacies. Voluntary organizations provide medical assistance and councils issue fellowships.

One writer said the first man on earth was the first doctor. This is an indication that medicine started through practice and experimentation, namely using herbs and trees. To survive and thrive, man utilized the environment in securing shelter food and medicine.

2.2"Women Local Knowledge in Agriculture"

• **Dr. Mohamed Tahir Jalaleden,** Msc in extension and rural development, Phd in extension and rural development, Dean of Technical Agriculture College in Aldalange University.

Abstrsct:

Local knowledge' systems are known to be highly complex and diversified. The have been revered to as fold sciences, ethnic sciences, people ecology or village sciences. Scientists in the field of social anthropology brought local knowledge into the open and introduced its systems. Social anthropologists are very enthusiastic about local knowledge and they always praise its usefulness and positive sides. These local systems, they argue, provide the best type of information on seasonal herbs and plants. Old women and young men are experienced in wild fruits useful for human consumption. Honey collectors know enough details on the flowering processes and the diversity of local plants. One of the local people emerges as having outstanding abilities, memory and intelligence in the field of local knowledge.

Women in the State of South Kordofan are by nature experts in local knowledge in general and agriculture in particular. They use local knowledge in handling situations, practices and activities. In fact, women are the backbone of maintaining food security for the family and the community at large.

Local knowledges have many dimensions such as language, medicine, clinical psychology, botany, biology, anthropology, ecology, climate, agriculture, animal breeding and crafts. However, the knowledge of rural people is not always sound and fruitful (Schamber, 1990).

This paper identifies some types of agricultural local knowledge that the women in South Kordofan know and practice.

2.3"Local Knowledge of Women in Climate Change in South Kordofan"

• **Dr. Professor Hassan SalihFandama**
Associated Professor

Abstract:

Environmental resources, like air, water, the climate and biological diversity, are deteriorating on an alarming scale. Similarly, world cultural diversity is declining. Each week, one language disappears out of 7000 languages worldwide, together with its cultural and philosophical content. Thus, human heritage is losing on serious rates. Thus, indigenous populations need support and assistance from local, regional and international communities. The aims are to boost the ability of maintain fragile and ignored environmental systems.

Coming climate changes are going to be of tremendous and devastating nature. Traditional methods of handling the climate will not be adequate to face the challenges ahead. All stakeholders are encouraged to interact with the issues of climate change. The indigenous populations do possess methods of dealing with the climate that pasted the test of centuries. They should be invited to participate actively in strategies for climate change.

3. Workshop on the "Role of diagnostic Radiology in early detection of Breast Cancer"

3.1 The Third Goal Indicators (Health) of United Nations Sustainable Development Goals:

• **Dr. Alshaffa Abdelgader Hassan** – director of UNESCO ISESCO Chair for women in science and technology

a) Doctorate of Philosophy in Education- General Curricula - 2007 -Sudan University for Sciences & Technology.

b) Master of Education by Syllabus- International Uni-

versity of Africa - Curricula and Teaching Methodologies (2003.)

c) Master of Arts in Translation (Arabic/ English) - Faculty of Languages - Sudan University for Sciences & Technology (2015.)

d) Honor Bachelors of Education – Teachers College – Wadi El-Niel University- Second Grade – First Section – Specialty (English Language- Islamic Education- Fine Arts) (1998.)

PhD Thesis Title:

Designing a program to qualify Primary Education's first Grade teacher based on competencies via Multimedia Integral Orientation.

Abstract:

Sustainable Development Goal 3 of the 2030 Agenda for Sustainable Development is devoted to "ensure healthy lives and promoting well-being for all at all ages". The associated targets, inter alia, aim to the reduction of global maternal mortality, the end of preventable deaths of new-borns, the end of the epidemics of AIDS, tuberculosis and malaria, as well as the reduction by one third of premature mortality from non-communicable diseases.

Every Woman Every Child is an unprecedented global movement that mobilizes and intensifies international and national action by governments, multilaterals, the private sector and civil society to address the major health challenges facing women and children around the world. The movement puts into action the Global Strategy for Women and Children's Health, which presents a roadmap on how to enhance financing, strengthen policy and improve service on the ground for the most vulnerable women and children.

The Commission on Sustainable Development considered Health and sustainable development as a cross-cutting issue during the two-year cycle of its multi-year programme of work.

Health and Sustainable Development was also an integral part of the World Summit on Sustainable Development, held in Johannesburg in 2002. The outcome document of the Summit, the Johannesburg Plan of Implementation, devotes Chapter 6 to Health and Sustainable Development, recalling that human beings are entitled to a healthy and productive life, in harmony with nature and further recognizes that the goals of sustainable development can only be achieved in the absence of a high prevalence of debilitating diseases, while obtaining health gains for the whole population requires poverty eradication.

3.2 Early Detection of Breast Cancer by Using Mammography:

• **Dr. IkhlasAbdelaziz Hassan Mohamed**- PhD in Diagnostic Technology, Sudan University of science and Technology 2009.

• M.Sc. Diagnostic Technology in Sudan University of science and Technology College of Graduate studies (2002).

• B.Sc. (First class, Honors) in Diagnostic Radiologic Technology, College of Medical Radiologic Science Sudan University of Science and Technology–Khartoum, Sudan 1997.

Diploma. (Distinction)High Institute of Radiography and Radiotherapy – Khartoum, Sudan 1985

Associate Professor of Diagnostic RadiologyCollege of Medical Radiologic Science-Sudan University of Science and Technology

Abstract:

The breast is a dynamic organ- undergoes cyclical proliferative changes throughout life under the influence of hormones and growth factors- so may be likely to be more altered by environmental carcinogens

Key function for ER and PR in breast cells. The same hormones that are important for breast growth during pregnancy are also important for breast cancer.

ER function in signaling through other growth factor receptor pathways becomes very important in cancer. Production of estrogen through alternate sources keeps E supply ongoing in postmenopausal women.

3.3Role of Ultrasonography and Advance Imaging Modalities in Diagnosis of Breast Cancer:

• **Dr. MunaAhmed Mohammed**

Sudan University of Science and Technology, College of Medical Radiologic Science

• PhD in Diagnostic Medical Ultrasound -Sudan University of science and Technology March 2010.

Thesis Title: Evaluation of Uterine Artery in Recurrent Abortion Using Color Doppler

• M.Sc in Diagnostic Medical Ultrasound -Sudan University of science and Technology College of Graduate studies (2004 – 2006).

Abstract:

What is Mammography?

Mammography is a specific type of breast imaging that uses low-dose x-rays to detect cancer early – before women experience symptoms – when it is most treatable

What are some common uses of the procedure?

• Mammograms are used as a screening tool to detect early breast cancer in women experiencing no symptoms. They can also be used to detect and diagnose breast disease in women experiencing symptoms such as a lump, pain, skin dimpling or nipple discharge.

• Screening Mammography

Mammography plays a central part in early detection of breast cancers because it can show changes in the breast up to two years before a patient or physician can feel them. Current guidelines from the U.S. Department of Health and Human Services (HHS) and the American College of Radiology (ACR) recommend screening mammography every year for women, beginning at age 40. Research has shown that annual mammograms lead to early detection of breast cancers, when they are most curable and breast-conservation therapies are available.

• The National Cancer Institute (NCI) adds that women who have had breast cancer, and those who are at increased risk due to a family history of breast or ovarian cancer, should seek expert medical advice about whether they should begin screening before age 40 and the need for other types of screening. If you are at high risk for breast cancer, you may need to obtain a breast MRI in addition to your annual mammogram.

3.4 Application of MRI in Characterize of Breast Tumors

• Dr. Asmaa Ibrahim Alamin

Abstract:

Breast magnetic resonance imaging (MRI) has been a very fast developing tool for the assessment of breast cancer and quickly moved from research to clinical settings. It is being used to evaluate patients with specific indications and as a screening tool for high-risk patients. The value of breast MRI arises from its very high sensitivity in detecting breast cancer but more importantly from its ability to functionally assess physiological and biochemical properties of breast tissue, thus

helping in the management of breast cancer, including the assessment of the extent of disease, the detection of contralateral disease, and the evaluation of treatment response. Response to treatment has been traditionally assessed based on gross tumor size change, a parameter that has been shown to have limitations in the accurate prediction of the treatment response and outcome. MRI offers functional methods to aid treatment response assessment that better reflect the viability of tumor and tumor burden versus just size changes. Understanding the indications for breast MRI, diagnostic criteria utilized to detect and characterize breast cancer, and technical challenges are important in both clinical and research settings. In this chapter we discuss the utilization of breast MRI in breast cancer diagnosis and staging, including the review of patterns of enhancement and principles of pharmacokinetic modeling for dynamic contrast-enhanced MRI, application of diffusion-weighted imaging and MR-guided breast biopsy, as well as review of technical considerations for optimization of image acquisition and assessment of treatment response.

2- Monthly Forums:

1.1 "Rolling-out of small scale biogas in Sudan - the obstacles and benefits"

• Dr. Hazer Farouk World Bioenergy Association.

Coordinator /Applied Science - UNESCO Chair

Sudan University of Science and Technology (SUST)

DirectorRoadmap Training Center

Oct. 2010 – Dec. 2013 Sudan University of Science & Technology (SUST) Khartoum, Sudan - UniversitiTechnology Malaysia (UTM) Johor, Malaysia Mechanical Engineering, PhD (Biofuel) Dec. 2003 – Dec. 2005 UniversitiTechnology Malaysia (UTM) Johor, Malaysia - Mechanical Engineering, Master (AMT), Good pass Sept. 1995 – July 2000 Sudan University of Science & Technology (SUST) Khartoum, Sudan Mechanical Engineering, Bachelor (B.Sc. - Honor) 1st class.

Abstract:

Rolling-out of small scale biogas in Sudan - the obstacles and benefits

Sudan has a high potential for production of biogas as an energy source for rural households that are otherwise totally reliant on wood and charcoal for cooking. It shares some significant common factors with many other countries which have developed a significant energy input using biogas from anaerobic digestion. These common factors include

• where a large percentage of the population live off the main electricity supply grid and where there is a large annual production of wet organic wastes, both at Household and small industry level,

• where cost of wood or charcoal for cooking and heating is rising, and/or its use is contributing significantly to deforestation,

- where the import of fossil fuels makes up an increasingly large and unaffordable part of overall imports,
- Where the wood and charcoal is used in less efficient cooking systems, often resulting in the people who do the cooking (usually women and girls) suffering from debilitating respiratory illnesses.

To be able to generate enough biogas for cooking, and possibly for lighting needs, every day and so achieve all these benefits, for one particular household it requires only about 25 kg of semi-dry animal manure or other equivalent feedstock (including food waste or vegetable wastes). This is enough for a well-designed and properly built bio digester of 3-4 cubic meters volume to produce over 1 cubic meter (m3) of biogas a day and so enough for the cooking needs for an average family.

The residue from the Digester is a good quality fertilizer for use for improving the growth of crops and vegetables for consumption or sale in many instances the savings to the household of producing their own cooking gas will mean the loan taken out to build the digester being 2 Paid off within less than two years (though this will vary country to country). After the loan is paid off the household will have more available money for spending on other things including education and healthcare.

In the countries that have installed significant numbers of digesters there are a number of reasons for the success of the program, and these include the putting in place of some necessary processes. These include:

- The promotion of the whole program,
- The development or accessing of the organization that will oversee and manage the whole process, including developing training for masons and householders, and supervise an effective quality control program,
- Training of masons (bricklayers and stone or cement workers) to build the digesters to an approved design and to a high quality,
- Arranging the necessary microfinance processes, either in banking systems or in religious organizations

1.2 "Development of the Design of Lightweight Steel Portal Frame Structures to Suit Earthquake-Prone Areas (Ph.D. Research)

• Dr. Alia Osman Mohamed Ahmed

(Ph.D. Research in structural engineering united kingdom)

Abstract:

Portal frame structures are widely used and have become the most often used structures within this sector. However, there is a need for a lightweight design that

is suitable for potential earthquake areas that could be easily transported and erected quickly following an earthquake and used for shelter, schools, hospitals, refugee camps etc. Likewise, they ought to be capable of resisting large aftershocks and could become a permanent building but might be removed and reused.

Very light weight thin gauge steel construction is light but is likely to buckle under large deflections. Such a characteristic is not desirable during earthquakes.

So I developed a design methodology to utilize slender steel (cold formed or thin walled steel) for the construction of portal frame buildings in earthquake prone areas as it will be economical, easy to fabricate and transport compared with the traditional heavy steel.

This had been achieved by designing some parts to yield and absorb the earthquake whilst protecting the slender components. In the event of the building resisting large aftershocks these (bolted-in) and cyclically yielded parts could be replaced but the remainder of the structure keeps undamaged. It was a new design methodology for earthquake resistant slender portal frame structure that rewarded patent.

2.3 "vitro and In vivo Antimicrobial Activity and Synergistic Interaction of some Essential Oils against Diabetic Wound Infections Associated Bacteria"

• Dr. Samah Awad AbduRahim Ali
Ph.D., M.Sc., FMLS, U of K, 2013

Abstract:

Background: Diabetic wound infection represents one of the risk factors that lead to serious complications especially in the foot where it can leads to extremity lower limb amputation. This risk was multiplied by the threatened effectiveness of many existing antibiotics by rapid emergence of multiple drug resistant bacteria that colonize the diabetic wounds. Essential oils (EOs) provide the opportunity for the development of new drugs have a therapeutic potential to treat diabetic septic wounds since they possess complex structure made them stubborn to the bacterial resistance. Combination therapy allows the production of multidisciplinary medicament that has the ability to target aerobic and anaerobic bacteria along with the improvement the wound healing

process in diabetic patients.

Methods: The essential oils of Foeniculumvulgare (fennel), Cinnamomumverum (cinnamon), Syzygiumaromaticum (clove) and Elettariacardamomum (cardamom) were screened for their antimicrobial activity using disc diffusion method. They were tested against three standard aerobic control bacteria, one Gram positive (Staphylococcus aureus ATCC 29213) and two Gram negative bacteria (Escherichia coli ATCC 25922, Pseudomonas aeruginosa ATCC 27853), and Clostridium perfingens as an indicator organism for anaerobes. The minimum inhibitory concentrations (MICs) and the minimum bactericidal concentrations (MBCs) of the EOs were determined according to the Clinical Laboratory Standard Institute provision (CLSI). The checkerboard test was used to assess the interaction between essential oils by calculation of the fractional inhibitory concentrations (FICs) and FIC indices. The EOs combinations that exhibited synergistic impact were tested against 75 multiple drug resistant (MDR) clinical isolates; 27 Methicillin resistant Staphylococcus aureus (MRSA), 21 Escherichia coli 4 of them were extended spectrum B lactamase producers (ESBL), and 23 Pseudomonas aeruginosa collected from Suba University Hospital, the protocol and ethical approach were approved by Sudan Ministry of Health.

The most potent EOs combinations were subjected to in vivo antibacterial and wound healing activities on the diabetic infected wounds of Wistar albino rats, in the animal house of the Faculty of Pharmacy, International University of Africa, and the ethical consideration for using animals was approved by the Institutional Animal Ethics Committee of the Department of Pharmacology. Type 1 diabetes mellitus was induced by alloxan monohydrate, then excision wounds were inflicted un-

der ether anesthesia.

Local infection was introduced into wounds with Staphylococcus aureus using a 108 CFU/ml inoculum, then the rats were divided randomly into five groups each group contain 7 animals, three groups (1, 2 and 3) received the polyethylene glycol based ointments of combinations in the dose1% (v/v) of fennel-cinnamon-clove, fennel-cinnamon-cardamom and fennel-cinnamon-clove-cardamom blends respectively, and group 4 received the standard drug ointment (2% Fusiderm) while the control group 5 was left without any treatment. The concentration of fennel EO in the blends was 0.4%, cinnamon EO was 0.3%, clove EO was 0.3% and cardamom EO was 0.3%. The potential of wound healing was assessed by contraction and confirmed by histopathological analysis. In vivo antibacterial activity was determined by means of viable counting technique.

Results: The preliminary screening of the four essential oils against the standard Gram positive bacterium (S.aureus) and the standard Gram negative bacteria (E.coli and P.aeruginosa) revealed that the tested bacteria has variable susceptibility patterns ranged from strong to mild susceptible. The highest activity against the S.aureus was demonstrated by fennel oil. Cinnamon oil exhibited the most potent activity against E.coli and P.aeruginosa

followed by clove oil, while cardamom oil showed the lowest activity. S.aureus was the most susceptible bacterium while P.aeruginosa showed the lowest susceptibility. Among 11 combinations tested, the combinations of cinnamon-clove, cinnamon-cardamom, fennel-cinnamon-clove, fennel-cinnamon-cardamom, cinnamon-clove-cardamom and fennel-cinnamon-clove-cardamom EOs demonstrated synergism against the three tested bacteria with FIC indices ranged from 0.1 to 0.44. Additionally, commixture of clove and cardamom oils give rise to synergistic impact against S.aureus and E.coli, while fennel and cinnamon oils output synergism against P.aeruginosa. All the tested combinations displayed inhibitory activity against all clinical isolates varied from

full inhibition (mean diameter zone of inhibition (MDZI) =60 mm) to mild inhibition (MDZI =11mm), and no resistance was demonstrated. Against Clostridium perfingens, cinnamon oil exhibited the most potent activity followed by clove oil, while fennel and cardamom oils exhibited moderate effects, the blends of cinnamon-cardamom demonstrated a synergistic effect. Regarding the wound healing activity, the wounded group (2) that contain fennel, cinnamon and cardamom EOs blends showed the minimum period of wound closure when compared with other four groups tested. The wound diameter in this group was significantly decreased and contraction was 100% completed in day (12), when Compared with Fusiderm and control groups which recorded contraction percentage of 81.6 % and 78.1% respectively in the same day. Similar to group (4) which treated with Fusiderm, on day (14), group (1) which contains fennel, cinnamon and clove EOs blends showed 100% wound contraction compared to contro rats (67.1%). Group (3) that contain fennel, cinnamon, clove and cardamom EOsl blends demonstrated marked deterioration in wound contraction in day 14 (32.5%) when compared with the contraction percentage of the control group, and the histopathological investigation showed the presence of inflammatory cells up to day (8). The total bacterial count from the pus on day (4) revealed that the application of the ointments of the tested EOs combinations resulted in a diminishing level of total S.aureus count in the infected wounds. There was a major reduction from 108 CFU/ml to 4×104, zero and 6×103 CFU/ml in groups 1, 2 and 3 respectively, while Fusiderm and control groups recorded 103 and 5×105 CFU/ml respectively. Conclusion: The EOs combinations of fennel, cinnamon, clove and cardamom had broad spectrum antimicrobial activity against aerobic and anaerobic bacteria that colonize the diabetic septic wounds. The ointments containing commixtures of fennel, cinnamon and clove, fennel cinnamon and cardamom, fennel, cinnamon, clove and cardamom EOs had in vivo antibacterial activity. Topical application of the ointment contains the blend of fennel, cinnamon and cardamom EOs to the diabetic wounded rats resulted in improvement of wound healing process, followed by the ointment contains fennel, cinnamon and clove EOs, while the ointment containing combination of fennel, cinnamon, clove and cardamom EOs exhibited delayed wound healing activity when compared with the group of normal healing control.