Project Title: The effects of cell mechanical property alterations on the survival of lung epithelial cells under shear stress

Primary Research Mentor: Dr. Huseyin Yalcin

Mentors: Dr. Ala-Eddin Al Moustafa

Students: Mahmoud Abdelrasool, Mohamed Ahmed, Maha Hussein, Salma Salman

Abstract:

Acute Respiratory Distress Syndrome (ARDS) is a serious condition manifested by the accumulation of edema fluid inside the lung due to inflammation. ARDS patients cannot inflate their lungs and therefore must be mechanically ventilated. However, stresses associated with enforced displacement of edema liquid via mechanical ventilation can damage delicate epithelium lining the walls of the small airways and alveoli. A solution for this case is proposed through the alteration of the cells' mechanical via steroidal drugs to decrease cell's mortality upon mechanical ventilation. In our work, cultured rat L2 alveolar EPCs were exposed to airway reopening conditions using a parallel plate perfusion chamber. Cells were pre-incubated with two selective anti-inflammatory steroids Dexamethasone (DEX), and Trans-Dehydroandrosterone (DHEA) that are expected to alter cell cytoskeleton hence mechanical properties. Cellular injury and cytoskeleton reorganization were assessed via fluorescent microscopy, whereas Atomic Force Microscopy was used to study cell mechanics. According to our results, pre-exposure of either DEX or DHEAS to cultured cells significantly decreased cellular injuries associated with mechanical ventilation as cell mechanics were significantly altered for both DEX and DHEAS exposed cells, with increased stiffness for DHEAS and decreased stiffness for DEX treated cells, suggesting altering cell mechanical properties via cytoskeleton reorganizations have potential benefits for cell survival against VILI. These results provide evidence for potential beneficial effects of anti-inflammatory agents DEX or DHEAS against for ARDS treatment. Results from this study are critical for VILI and be readily applicable to future clinical studies for VILI.
Project ID: UREP21-060-1-012
Institution: Qatar University

Project Title: In-vitro Assessment of Qatari halophytes for Antifungal Activities

Primary Research Mentor: Dr. Mohammed Abu-Dieyeh

Mentors: Dr. Fatima Al-Naemi

Students: Oumaima Mabrouk, Israa khatib, Amani Al-Muree, Eiman Al-Hajri, Jawahir Alshammeri, Lozan Riyadh

Abstract:

Despite emphasis on research of synthetic antimicrobial drugs, a certain interest in medicinal plants has been re-born, in part because many synthetic drugs are potentially toxic and are not free of side effects. Therefore, searching for new antimicrobial substances from natural sources and evaluating their efficacy on microorganisms have been encouraged. Ten (10) Halophytic plants were sampled from Qatari environment, dried, grinded and aqueous and ethanolic extracts were prepared. The antifungal activities of the extracts were tested against a wide spectrum of fungal species. 10 mg/ml of ethanolic extracts of more than one plant species was enough to completely prevent the growth of certain fungi and exhibited about 70% growth inhibition on others. The main finding of this research is the presence of antifungal activities in all studied species. An interesting finding is that the ethanolic extract of almost all plants is more influential against fungal growth compared to aqueous extracts. Moreover in most studied plants, ethanolic root extract exerted greater inhibition on fungal growth than ethanolic leaf extract. Qatari halophytes are promising for developing natural fungicides that can be utilized in different therapeutic and pharmaceutical products like medicine, cosmetics, toothpastes, creams and lotions to suppress or prevent fungal infection. Based on our findings, we hypothesized that the antifungal compounds of halophytic plants is not mainly dissolved in water and retained in the roots instead of aboveground foliage to avoid being lost by desiccation in an arid environment. Further research is needed to test the above-mentioned hypothesis.
**Project Title:** Effect of Crude Extract from Qatari Medicinal Plants on Breast Cancer Cell Proliferation

**Primary Research Mentor:** Dr. Haissam Abou-Saleh

**Mentor:** Dr. Allal Ouhtit

**Students:** Lubna Zarif, Afnan Barhoush, Amira El-Shayeb

**Abstract:**

Cancer is an increasing epidemic worldwide. It was estimated that around 8.2 million individuals died in 2012 due to cancer. Breast cancer (BC) is the most common type of cancer affecting women worldwide and has the second highest cancer mortality rate. The rate of breast cancer among the Qatari residents and citizens is 39.41%, with a survival rate of 98% during early stages of diagnosis and 58% in late stages. In 2015, 19% of cancer related death was due to breast cancer. Conventional treatments of breast cancer are hindered by systemic side effects and decreased quality of life for patients during the course of the treatment. Therefore, there has been a shift in interest in using complementary and alternative medicine (CAM). This study was conducted to identify the anti-proliferative effects of crude extract isolated from Qatari medicinal plants, *Plantago ciliata* and *Convolvulus pilosellifolius* on breast cancer cells MDA-MB-231. The crude extracts from both plants were prepared using 3 solvents: methanol, acetone, and water. These extracts were then tested on MDA-MB-231 BC cells, and a dose-response curve was obtained. Significant inhibition was obtained with a concentration of 60 mg/ml for water and 20 mg/ml for both methanol and acetone. In particular, water extract from both plants showed the most potent effect on the cells. The long-term objective of this study is to build a foundation for further research aiming towards chemoprevention approach, to recognize target that can guide in anticancer therapeutic strategy.
**Project Title:** Prevention and screening recommendations in type 2 diabetes: Review and critical appraisal of clinical practice guidelines

**Primary Research Mentor:** Dr. Bridget Paravattil Javed

**Research Mentors:** Mohammad Diab, Kyle John Wilby

**Students:** Nancy Zaghloul, Sawsan AlMukdad, Huda Barhoosh, Mayar Ashour, Iman Abdelrahman, Balqis Daoudi

**Abstract:**

**Background**
The management of type 2 diabetes (T2DM) is guided by clinical practice guidelines (CPGs). Recommendations contained within CPGs should be based on the best available scientific evidence. However, CPGs are not always subjected to rigorous evaluation prior to dissemination and lack information regarding how recommendations can be translated into key performance indicators (KPIs) for international contexts.

**Objectives**
The objectives were to identify and appraise guidelines reporting recommendations for screening and prevention of T2DM and to translate appraised guideline recommendations into KPIs.

**Methods**
This was a multi-phase project in which investigators conducted a systemic review of published diabetes screening and prevention guidelines, critically appraised the identified guidelines using the AGREE II tool, and conducted two focus groups to determine key diabetes performance indicators relevant for practice in Qatar.

**Results**
The highest scored domain across all appraised guidelines was ‘clarity of presentation’ while the lowest scored domain was ‘rigor of development’. Results were similar for prevention and screening recommendations. All appraised guidelines were recommended for use or recommended after incorporation of specific modifications. According to the academic clinicians, key performance indicators focusing on interventions to prevent T2DM were more important than performance indicators related to screening which contrasted with healthcare providers who ranked screening indicators above prevention indicators.

**Conclusion**
Diabetes Canada Guideline (DCG) was identified as the highest quality guideline based on the AGREE II instrument. Accordingly, healthcare providers and academic clinicians agreed that many of the key recommendations from the DCG are relevant for practice in Qatar.
**Project Title:** Role of the gut microbiota in Autism Spectrum Disorders and Inflammatory bowel diseases.

**Primary Research Mentor:** Ghizlane Bendriss, PhD  
**Mentors:** Dalia Zacharia, PhD; Noha Yousri, PhD  
**Students:** Dana El Ali, Ameena Shafiq, Nada Mhaimeed, Mohammed Salameh, Zain Burney, Krishnadev Pillai

**Abstract:**
Studies exploring the ‘Gut-Brain axis’ suggest that gut dysbiosis could be involved in pathogenesis of diseases. This pilot study was composed of two study arms: 1/ Assessing and raising awareness among healthcare professionals, scientists and public on the role of gut microbes in health and diseases. 2/ Profiling and comparing the gut microbial composition in a cohort of 55 volunteer patients with neuropsychiatric disorders (ASD/ADHD), gastrointestinal disorders (IBD/IBS) or healthy individuals (controls).

A total of 157 participants were recruited for the two legs of the study via social media, email, and seminars to answer a questionnaire; 55 of them provided a stool sample for analysis. DNAs were extracted using the Qiagen stool-minikit; samples were sent for 16s rDNA as well as ITS sequencing. A linear regression analysis was done using the R package for correlation analyses. We identified a list of taxonomic groups and ratios that are associated with the ASD/ADHD or IBD/IBS groups (p-value < 0.05). We identified unique bacterial and fungal operational taxonomic units (OTUs) to each group, which could constitute good candidates for new biomarkers. The abundance of species in the ASD/ADHD group and the IBD/IBS group are significantly decreased which confirms a decreased biodiversity shift. Awareness and readiness of healthcare professionals and general public on the importance of gut microbes is significant enough in Qatar for considering the launching of a clinical trial involving dietary modulation of the gut microbiota in these two groups of conditions. A literature review was published for our awareness campaign.
Project Title: In-vitro plant tissue culture: An Alternative Source of Bioactive molecules in the rare medicinal plants in Qatar

Primary Research Mentor: Dr. Talaat Ahmed

Mentors: Dr. Amjad Shraim and Dr. Mohammed Alsafran

Students: Aziza Al-Aidaroos, Ghada Deeb, Marwa Elbasha, Aisha Alhelabi, Lina Layth, Aya Ali

Abstract:

An efficient in-vitro culture system to induce callus from three desert plant species (Convolvulus pilosellifolius Desr, Prosopis cineraria and Glossonema varians) was established to test their abilities to accumulate bioactive molecules compared with intact plant growing in nature. Results indicated that in Glossonema varians the MS media supplemented with 0.5 mg/L, 1.0 mg/L and 2.0 mg/L of 2,4-D with NAA combination were the best medium for callus induction from cotyledons and root tissues. In, Convolvulus pilosellifolius Desr the highest callus induction (100%) was obtained from leaves on MS media with 0.5 mg/L (2, 4-D + BAP) combination. Moreover, Prosopis cineraria, results showed that the maximum callus induction was under 1 mg/L of 2, 4-D. Qualitative analysis by HPLC showed a significant difference between Glossonema varians callus and leaves extracts. It was clear from the number of peaks that the number of compounds in each mixture were different. Callus extract showed 28 peaks, while leaves extract showed 28 peaks that are different in concentrations and types. Regarding Convolvulus pilosellifolius Desr, the callus and leaves extracts gave different extraction yield and intensity. In case of Prosopis cineraria, there were significant differences in peaks intensities of both callus and leaves, which propose the variation in the amount of metabolites for each sample. In conclusion, to avoid the need of relying on wild plants and save our environment, plant tissue culture technique could be an excellent alternative for production of the natural bioactive compounds, as it does not depend on the geographical environments.
**Project Title:** Biodiversity of indigenous Qatari bacteria, responsible of minerals formation in Qatari sabkhas and soil stabilization by Microbially Induced Carbonate Precipitation

**Primary Research Mentor:** Prof. Nabil zouari

**Mentors:** Prof Samir Jaoua

**Students:** Sara Wahib, Imane Hassan, Ghaida Elhaj, Rasha Ghanoun, Nouha Abdelaziz, Shatha Al-Khanji

**Abstract:**

Biomineralization plays a key role in modifying geological properties of soil and evaporitic environments (i.e sabkhas), thereby stabilizing soil against wind erosion, especially in area characterized with harsh weather and soil; i.e. Arabic Gulf region. In Sabkhas, biominalizing bacteria are involved in minerals formation, with a special focus on dolomite, the reservoir of Gulf oil and gas. In this work, we showed that among Qatari soil microorganisms, ureolytic bacteria are capable of modifying soil characteristics and thus, inducing biominalisation. Occurrence and diversity of ureolytic bacteria in Qatari soils were investigated, especially to study their acquired potential to adapt to harsh conditions exhibiting ureolytic activity. Soil samples were collected from various locations in Qatar and used to isolate the indigenous ureolytic bacteria. MALDI-TOF MS was used for identification and differentiation of isolated bacteria. Therefore, we demonstrated biodiversity and recorded the indigenous ureolytic bacteria in Qatari soil that have the ability to perform biominalization and thus can be helpful to stimulated, to enhance soil stabilization, and for other local applications as well, since they are adapted to soil and weather conditions. A collection of indigenous bacteria from Qatari soils, identified and categorized based on their protein profiles, responsible of soil stabilization by Microbially Induced Carbonate Precipitation (MICP) and mineral formation inducing bacteria was constructed and applied at local harsh weather and soils. We demonstrated for the first time in the field conditions, that Qatari bacteria can stabilize soil by formation of carbonate minerals, which enhanced the strength and stability of the soil.
Project ID: UREP22-140-3-023
Institution: Qatar University

Project Title: Sildenafil-MIL-89 Conjugate as a Potential Drug Delivery Vehicle in Pulmonary Arterial Hypertension

Primary Research Mentor: Dr. Haissam Abou-Saleh

Mentors: Dr. Allal Ouhtit

Students: Dana Essa Al-Ansari, Amal Abou Samhadaneh, Rahaf Tawakul

Abstract:

Introduction and Objectives:
Pulmonary Arterial Hypertension (PAH) is an aggressive disease with poor prognosis, no available cure, and low survival rates. Several classes of vasodilator drugs are commonly used as treatment strategies for PAH including sildenafil (Sil), a phosphodiesterase type 5-inhibitor. Despite their clinical benefits, these therapies are hindered by their side effects. This limitation could be overcome by controlled drug release using a nanomedicine approach. In this study, we evaluated the potential use of a highly porous nano-sized preparation of iron-based metal-organic framework (MOF) commonly referred to as nanoMIL-89. We examined the cellular uptake of MIL-89 by PAH relevant cells using light, confocal and transmission electron microscopes. We assessed the viability, cytotoxicity and anti-inflammatory effects of MIL-89 and Sil-nanoMIL-89 conjugate on PAH relevant cells in vitro using AlamarBlue™, LDH and cytokine release. Furthermore, the toxicity of nanoMIL-89 was assessed in vivo using zebrafish embryos.

Results:
Microscopic images showed a higher cellular uptake of MIL-89 and transfer to daughter cells in PAH relevant cells. Although nanoMIL-89 affect the cell viability at high concentrations; it does not cause any significant cytotoxicity. Moreover, nanoMIL-89 and Sil-nanoMIL-89 were shown to have anti-inflammatory effects as they reduce the cytokine release by PAH relevant cells. The in vivo study showed that high concentrations of nanoMIL-89 delay zebrafish embryos hatching and cause heart deformation, which is currently under investigation using cardiotoxicity markers.

Conclusion:
nanoMIL-89 is a promising formulation prototype for drug delivery. This study indicates that nanoMIL-89 are safe nanoparticles with anti-inflammatory effects. Further investigations, including diseased models and drug-loaded formulations are required.
Project Title: Anti-Breast Cancer Effect of Selective Qatari Medicinal Plant Crude Extracts

Primary Research Mentor: Dr MD Mizanur Rahman

Students: Arshiya Sayed Anwar Husaini, Ruqaia Shoheeduzzaman

Abstract:

Breast cancer is the most commonly diagnosed cancer among women around the world, including Qatar. Although numerous treatments exist, these conventional treatments are often ineffective over time, are toxic to normal cells, and have severe side effects. Therefore, Complementary Alternative Medicines (CAM) are gaining attention due to their safety and effectiveness. This study aims to determine the anti-breast cancer effect of some Qatari medicinal plants. We tested the alcoholic crude-extract of Nigella sativa (NS) seeds, Senna italica, Glossonema edule, and Convolvulus Glomeratus Choisey leaves against breast cancer cell survival, proliferation, and migration. Our data revealed that crude extract of Glossonema edule did not have any significant effect on breast cancer cell killing. However, crude extract of Senna italica and Nigella sativa had minimal breast cancer cell killing effect. Interestingly, crude extract of Convolvulus Glomeratus Choisey showed strong breast cancer killing effect. Surprisingly, scratch wound migration assay showed that all the crude extracts tested had the capacity to inhibit breast cancer cell migration. We further analyzed the molecular mechanisms of anti-breast cancer effect of Convolvulus Glomeratus Choisey as it showed the best effect. Pro-apoptotic effect of Convolvulus Glomeratus Choisey crude extract was confirmed by fluorescence activated cell sorting (FACS) using Annexin V/PI staining, and by western blot for pro-apoptotic marker caspase 3. Further fractionation studies are required to determine the active compounds of these medicinal herbs, which exert its anti-breast cancer effect. After successful animal and human studies, this Qatari native plant could be a promising natural remedy against breast cancer.
**Project Title:** The Impact of Sleep on Health and Cognition in Young Adults

**Primary Research Mentor:** Professor Shahrad Taheri

**Mentors:** Dr Odette Chagoury

**Students:** Akash Keluth, Pratyaksha Sinha, Basel Humous, Cleo Reyes, Fathima Zahir, Dana Al-Majed, Raffaella Evans

**Abstract**

Adults spend about one third of their lives sleeping. Sleep has an important role in homeostatic mechanisms. Several studies have shown that sleep duration has declined over the years at the same time as obesity prevalence has increased. Previous studies have also shown an association between sleep duration and obesity, hypertension, and reduced cognitive function. The aim of this study was to examine the association between sleep duration and obesity and cognitive function in university students. We recruited 161 students whose sleep was assessed using actigraphy (wrist-worn accelerometry). Cognition was tested using the CANTAB battery of tests. We analysed 95 actigraphs. Further actigraphy and CANTAB analysis are ongoing. The data collected were analysed using t-tests, Fisher’s exact test, and univariate and multivariate regression. We observed that sleep duration was negatively associated with waist circumference and systolic (but not diastolic) blood pressure. The associations observed confirm sleep’s role in body weight and blood pressure regulation. Further analyses are underway to confirm these findings as well as examining the impact of sleep on cognition. If confirmed, improving sleep duration may be an important approach for prevention and treatment of obesity and cardiometabolic disease.
**Project Title:** The potential antibacterial effect of the Marine Sponges of the Qatar Marine Zone

**Primary Research Mentor:** Dr. Bruno Welter Giraldes

**Mentors:** Alexandra Leitão; Nahla O. Ahmed Eltai

**Students:** Asma A. Ahmed, Kamelia O. Ahmed, Hadil A. Abdulkader, Halah A. Al-Korbi

**Abstract:**

This is a pilot study using the expertise from two different fields: Marine taxonomy and microbiology. Due the gap in taxonomic description in the region, this study evaluated the antibiotic activity of the substances extracted from two abundant species observed inhabiting the hyperarid mangrove of Qatar. As a curious result, the two first studied species were considered new for science: named here as Chalinula qatari nov.sp. and Suberites luna nov.sp.. For both species, the drug extraction protocol was performed, and the antibacterial experiment was performed to identify the species with bioactive potential. It was used a strain with 17 bacteria species (gram positive and negative). The extract of Suberites luna nov.sp is bioactive over the recognized pathogens Staphylococcus epidermidis, Staphylococcus aureus, Enterococcus faecalis. Following the taxonomic protocol for species identification, we found, photographed in the field, collected, deposited in the marine collection of the ESC and performed the preliminary taxonomic identification of other 15 sponge species inhabiting the oyster beds, coral reefs and seagrass seascapes in Qatar Marine Zone. This study is highlighting the importance in increasing the effort in studying the drugs in the hyperarid conditions, the importance in protecting natural resources with economic potential for development of new products and drugs, and the importance in correlate taxonomy with microbiology (biomedicine) for the identification of marine drugs.