Solubility and Anti-Fungal Potential of Curcumin against Candida Albicans and Cryptococcus Neoformans

Aiesha Ismael* Edwina Brennan* Seamus Cassidy**

Background: Curcumin is a compound derived from Curcuma Longa, which has been shown to have diverse biological effects. Studies revealed that the solubility of curcumin is low in non-polar solutions and that the antifungal capacity of curcumin is comparable to antifungal drugs.

Objective: To investigate the solubility of curcumin in various solutions and the anti-fungal potential of curcumin against Candida albicans and Cryptococcus neoformans.

Setting: Royal College of Surgeons in Ireland – Medical University, Kingdom of Bahrain.

Method: Curcumin was added to various solvents: DMSO, Tween20 and sunflower oil. Serial dilutions with deionized water were carried out and were monitored after 24 hours. Precipitation, if any, was determined under UV light. Curcumin was dissolved in filter-sterilized solvents for microbial studies. $1x10^6$ CFU/ml of fungal cells were incubated at 37°C for 48 hours in curcumin (500-0 µg/ml) in 96 well plate, and the turbidity was recorded. Fungal cells were also incubated in the solvent without curcumin.

Results: No microbial growth was observed in the presence of curcumin or in the positive control, DMSO without curcumin, for both strains. Growth was only observed in dilutions greater than 1:8 where curcumin precipitation was found. Similar results were found using DMSO: Tween20 (1:1). When sunflower oil was used, two clear layers of oil and broth were observed. Also, fungal growth was found in both the presence and absence of curcumin.

Conclusion: These solvents are not suitable for the antimicrobial analysis of curcumin. More studies are needed to determine suitable solvents to test the antimicrobial capacity of curcumin.

*** RCSI-MUB Medical Student**
**** RCSI Faculty**

Exploring the Effects of Visible Light on the Photostability of Curcumin Derivatives

Fatima Hassan Mohammed* Fryad Zeki Henari* Seamus Cassidy**
Fiza Rashid-Doubell**

Objective: To determine the photostability of curcumin and its derivatives (Boron Complex, Iron complex, Dilauroyl ester and Dibenzoyl ester) upon exposure to visible light.

Design: Quantitative Measurements.

Setting: Royal College of Surgeons in Ireland – Medical University, Kingdom of Bahrain.

Method: Two concentrations (0.3mM and 0.03mM) of curcumin and its derivatives were prepared in 100% DMSO and the absorbance spectrum over a range of wavelengths (200-1000 nm) was measured using a spectrophotometer. Data were collected after 0 hour, 24 hours, 48 hours, 72 hours and 96 hours of exposure to visible light.

Result: Curcumin and its derivatives showed a strong absorption in the UV-visible region. They also had different absorption region due to the nature of their chemical structures. Curcumin and its derivatives were photolabile at low concentrations and more stable at higher concentrations over the 96 hour period. The iron complex (0.3mM and 0.03mM) with curcumin was the most stable while Dibenzoyl (0.03mM) and Dilauroyl (0.03mM) were the least stables. This might be due to the presence of β-diketone moiety present in both esters.

Conclusion: The presence of the keto-enol tautomeric group in the chemical structure is the main contributor to the instability of curcumin derivatives.

*** RCSI-MUB Medical Student**
**** RCSI Faculty**

Understanding Macrophage Immune Response to Substrate Stiffness

Rukmani Sridharan* Andrew Cameron* Daniel Kelly* Fergal O'Brien* James Cowman**

Background: Biomaterials are used in regenerative medicine to restore physiologic function. They are engineered with properties that engage the immune system to promote a favorable healing response. Macrophages are the first to react upon implantation of a biomaterial. These cells are known to polarize into two functional phenotypes: M1 pro-inflammatory and M2 anti-inflammatory/pro-healing.

Objective: To evaluate the effect of substrate stiffness on macrophage polarization and to extrapolate this information towards the development of a biomaterial with enhanced healing properties.

Design: Experimental Study.

Setting: Tissue Engineering Research Laboratory, Royal College of Surgeons in Ireland, Dublin.

Method: Macrophages (THP-1 cell line) were cultured and seeded with nutrient media onto a plastic control and polyacrylamide gels of different stiffness grades; soft (11Kpa), medium (88Kpa), stiff (323Kpa). After a three-day culture, morphological characteristics and protein secretion (specifically pro-inflammatory TNFα and anti-inflammatory IL10) were observed using microscopy and ELISA respectively.

Result: Cells cultured on the medium stiffness gels consistently expressed an anti-inflammatory M2 phenotype, with elevated levels of IL10 and decreased levels of TNFα secretion.

Conclusion: The data suggests that macrophages are sensitive to substrate stiffness and also identifies biomaterial stiffness as an important modulator of the immune response to biomaterial implantation.

* **RCSI-Dublin Student**
** **RCSI-Bahrain, RCSI-Dublin Faculty**

A Quantitative Study of Hunter-Schreger Bands in the Tooth Enamel of Camelus Dromedarius

Ameera Radhi* Robin O'Sullivan* Christopher Lynch* Khalifa Elmusharaf**

Background: HSBs are considered relevant to tooth wear, the resistance of enamel to fracture, cracked tooth syndrome, enamel bonding, abfraction, vital tooth bleaching and even forensic identification of individuals.

Objective: To describe the morphology of the dromedary camel dentition, and to quantify the packing density of Hunter-Schreger Bands (HSBs) within their enamel. HSBs are an optical phenomenon related to the changes in the directions of enamel prisms as they pass through enamel.

Design: A Descriptive Animal Study.

Setting: Royal College of Surgeons in Ireland – Medical University, Kingdom of Bahrain.

Method: Two hundred twenty-nine camel teeth (194 deciduous teeth, and 35 permanent) were extracted from the heads of ten juvenile camels which were buried for a minimum of three months to remove the soft tissues. Two hundred twenty teeth were included in this study. The dentitions in the skulls of six mature camels in the Hunterian Museum of RCSEng in London were also examined. Ground longitudinal sections were made from 49 anterior teeth in the mid-mesiodistal and mid-buccolingual planes. Reflected light photomicroscopy was used to demonstrate HSBs in all regions of the enamel and quantify their packing density.

Result: A consistent pattern of variation in HSB packing density in different segments of the enamel was demonstrated. An acid-etch technique to enhance the HSB appearance was also tested and found satisfactory.

Conclusion: The morphology of camel dentition is more complex than human teeth, and HSBs do exist in the tooth enamel of Camelus dromedarius, with a predictable pattern of variation in their packing density.

* **RCSI-MUB Medical Student**
** **RCSI Faculty**

A Pilot Study on the Prevalence of BRCA1 185del and BRCA2 C.8680C>T in Bahraini Female Patients with Breast Cancer

Batool Al Mosawi* Fatema Ahmed Ali* Fatema Al Hannan* Latifa Al Buainain**

Objective: To evaluate the prevalence of BRCA1 185delAG and BRCA2 c.8680C>T in Bahraini female breast cancer patients.

Design: A Cross-Sectional, Pilot Study.

Setting: Royal College of Surgeons in Ireland – Medical University, Kingdom of Bahrain.

Methods: From April 2015 to August 2015, Deoxyribonucleic acid samples from 35 Bahraini females with breast cancer were investigated for BRCA1 185delAG and BRCA2 c.8680C>T mutations. For this purpose, PCR-RFLP protocols were employed.

Results: The findings revealed that none of the patients had shown the BRCA1 185delAG and BRCA2 c.8680C>T mutations.

Conclusion: Further research should be conducted on the genetic factors that contribute to breast cancer risk in the region, especially that family history of breast cancer was found to be a leading cause of breast cancer in Bahrain.

* **RCSI-MUB Medical Student**
** **RCSI Faculty**