

Final report to Breast Cancer UK February 2017.

Grant holder: Professor Philippa Denise DARBRE
Title of project: Measurement of UV filters in human breast tissue.
Project start date: 1 August 2015
Financial support: £15,000.
University of Reading account number: H5212200

Aims of this project

The specific aims of this project were to measure by liquid chromatography – tandem mass spectrometry (LC-MS/MS) the concentrations of the ultra-violet light (UV) filters benzophenone-3 (BP-3), octylmethoxycinnamate (OMC), 4-methylbenzilidene camphor (4-MBC) and homosalate (HS) in 120 samples of human breast tissue taken from 40 patients with primary breast cancer at three serial locations across the breast from underarm region to sternum. In a pilot study, BP-3 and OMC were detected in all of 20 human breast tissue samples. Although measurement of 4-MBC and HS was more sporadic, it was agreed to continue to include 4-MBC and HS in future analyses because this would provide a larger set of analyses and it would involve no additional cost. This grant provided financial support for analysis of the other 100 samples.

Results

I extracted the UV filters myself by a method analogous to that used to extract oestradiol from human breast tissue (Van Landeghem *et al.*, 1984) and as used for the earlier measurements of parabens in breast tissue (Darbre *et al.*, 2004; Barr *et al.*, 2012). The 100 extractions of human breast tissue samples were then supplied to MScan as dried extracts for analysis by LC-MS/MS (plus blanks and plus samples in duplicate for method recovery

analysis) and all analyses have been completed. A copy of the final report from MScan is attached (document 2.)

The concentrations of OMC, Bp3 and 4MBC as measured per vial by MScan then had the relevant blank values subtracted and were normalised to ng per g tissue. Homosalate was not detected in any of the tissue extracts. The data were then sorted according to linear patient number and serial location across the breast. At least one of the UV filters was detected in 101/120 (84%) of the tissue samples. OMC was measured in 89/120 of the tissue samples with a range of 0-58.7 ng/gm tissue, Bp3 was measured in 83/120 of the tissue samples with a range of 0-26.0 ng/gm tissue, and 4MBC was measured in 15/120 of the tissue samples with a range of 0-25.6 ng/gm tissue. Both OMC and Bp3 were measured in 72/120 of the tissue samples. Of the 15 tissue samples containing detectable 4MBC, 4 tissue samples had also OMC and Bp3.

Considering the detection of the UV filters in the three breast regions for each patient, OMC was detected in at least one breast region for 33/40 of the patients, in all breast regions for 25/40 of the patients and in the region of the tumour for 30/40 of the patients. Bp3 was detected in at least one breast region for 33/40 of the patients, in all breast regions for 22/40 of the patients and in the region of the tumour for 30/40 of the patients. 4MBC was detected in at least one region for 7/40 of the patients, in all regions for 2/40 of the patients and in the region of the tumour for 6/40 of the patients. There were only two patients out of the total 40 patients who had no detectable level of OMC, Bp3 or 4MBC in any tissue sample from their breast.

References cited:

- Van Landegham AAJ, Poortman J, Helmond-Agema A, Thijssen JHH. 1984. Measurement of endogenous subcellular concentrations of steroids in tissue. *J. Steroid Biochem.* 20: 639-644.

- Darbre PD, Aljarrah A, Miller WR, Coldham NG, Sauer MJ & Pope GS. 2004. Concentrations of parabens in human breast tumours. *Journal of Applied Toxicology* 24: 5-13
- Barr L, Metaxis G, Martin C, Harbach CAJ & Darbre PD. 2012. Measurement of paraben concentrations in human breast tissue at serial locations across the breast from axilla to sternum. *Journal of Applied Toxicology* 32: 219-232

Results output and dissemination

The results are currently being collated into a scientific publication which will be submitted to the peer-reviewed scientific journal, *Journal of Applied Toxicology* (Publisher - John Wiley and Sons). The title of the publication is planned to be “Measurement of concentrations of UV filters in human breast tissue at serial locations across the breast”. I will remain in contact with BCUK concerning this publication and will advise on dates of submission and outcome of submission.

Summary of expenditure:

This grant provided solely for financial support for the LC-MS/MS analyses from MScan in Wokingham. Due to the time elapsed from the original quotation, a new quotation (Q202-001v2 dated 10 Dec 2015) was issued from MScan (document 3 attached) but which remains at the same costing as submitted with the original grant application. This costing of £15,000 was committed in a university purchase order (number 3191679 dated 01 February 2016) (document 4 attached). The analyses have now been completed and all payments made to MScan. A final signed statement of expenditure from the University is attached (document 5).

Philippa Darbre (February 2017).