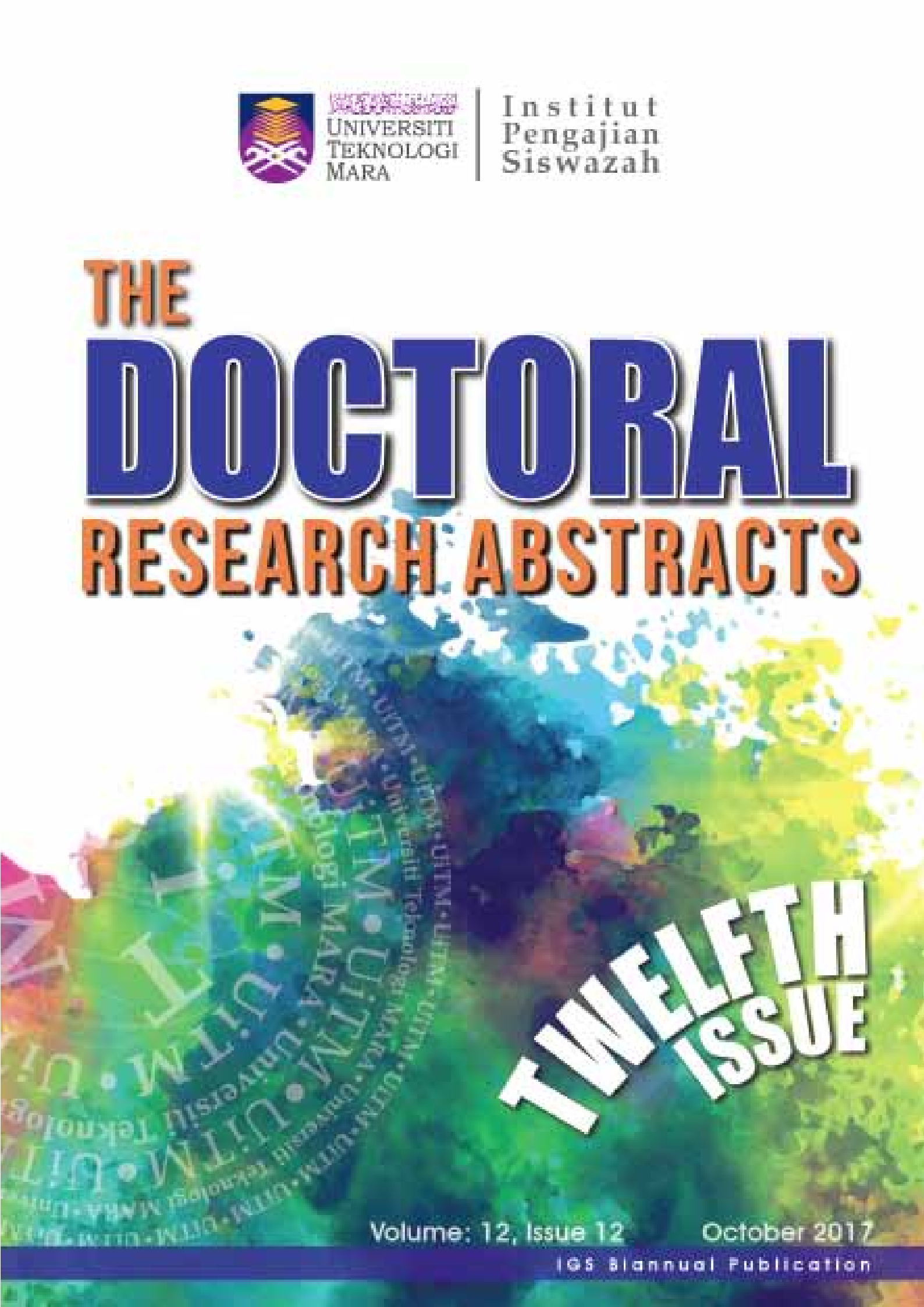
UNIVERSITI TEKNOLOGI MARA
Institut Pengajian Siswazah

THE DOCTORAL RESEARCH ABSTRACTS



Volume: 12, Issue 12 October 2017
IGS Biannual Publication

FACULTY OF HEALTH SCIENCE

43

Name : IZA NURZAWANI BINTI CHE ISA

Title : PHYSIOLOGICAL EFFECTS OF PRENATAL ULTRASOUND EXPOSURE ON BONE-RELATED DEVELOPMENT OF YOUNG RABBITS

Supervisor : ASSOC. PROF. DR. SULAIMAN MD DOM (MS)
DR. HAIRIL RASHMIZAL ABD RAZAK (CS)

Prenatal ultrasound examination is routinely carried out on most pregnant women since it is considered to be safe. The procedure is however often exploited for social and business interest rather than for medical diagnosis. Despite this procedure having an excellent safety record, ultrasound imaging tends to evoke temperature increase due to heat absorption from prolonged ultrasound beams and leads to intrauterine hyperthermia. This ex-vivo experimental study was conducted to examine bone-related physiological changes of young rabbits exposed prenatally to ultrasound. Oryctolagus cuniculus were time-mated and assigned into control and experimental groups. The control group was allowed to have a full term delivery without any exposure to ultrasound. Each pregnant doe in the experimental group received a single exposure to ultrasound during the applicable gestational stage of the group to which it was assigned. The exposure lasted 30 min, 60 min, and 90 min at 1st, 2nd and 3rd stage, accordingly. For each exposure, the working frequency used was 5.76 MHz, and the mechanical (MI) and thermal indices (TI) recorded were 1.0 and 0.2, respectively. The calculated spatial peak-pulse average intensity (ISPPA), spatial peak temporal average intensity (ISPTA), and acoustic output power (P) were 1055 Wcm^{-2}, 7.21 $mWcm^{-2}$, and 20.20 mW, respectively. Once delivered, the offspring were used for data analysis. The 1 and 5 months subjects exposed prenatally to ultrasound at 2nd and 3rd stage for 90 min showed significant reduction ($p<0.05$) in body length, femoral width and femoral length. Red blood cell and haemoglobin were found to reduced significantly ($p<0.05$) in 1 month subjects at 1st and 2nd stage for all exposure duration, but no significant changes ($p<0.05$) noted in 5 months subjects. The exposure has also significantly affected ($p<0.05$) the parathyroid activity in 1 month subjects especially at 3rd stage for all exposure duration which cause a disturbance in the serum calcium level. The studied animal of 1 and 5 months age has shown poor bone status as described by significantly reduced ($p<0.05$) in trabecular bone volume (BV/TV), trabecular thickness (Tb.Th) and trabecular number (Tb.N) after exposure at all gestational stages. Significant increased ($p<0.05$) in porosity and tissue mineral density were found in both 1 and 5 months subjects after exposure at all gestational stages. Osteocytes loss were found higher ($p<0.05$) in experimental groups of both 1 and 5 months subjects especially after 60 and 90 min of exposure in 2nd and 3rd stages as compared to control. The infrared microspectroscopic analysis demonstrated that the exposure increases tissue mineralisation without changing the stoichiometry of the bone as almost no significant changes ($p<0.05$) noted in mineral-to-matrix ratio (M/M), mineral crystallinity (XST) and collagen maturity (XLR) in 5 months subjects. However, in 1 month subjects, significant reduction ($p<0.05$) were found in diaphyseal M/M, XST and XLR after 90 min of exposure. The present study describing the detrimental effects following prenatal ultrasound exposure indicates that distinct skeletal alterations take place in young rabbits. The bony properties observed in the study showed significant impact on the bone quality. It is anticipated that this new knowledge may result in a precautionary measure in obstetric ultrasound scanning.