

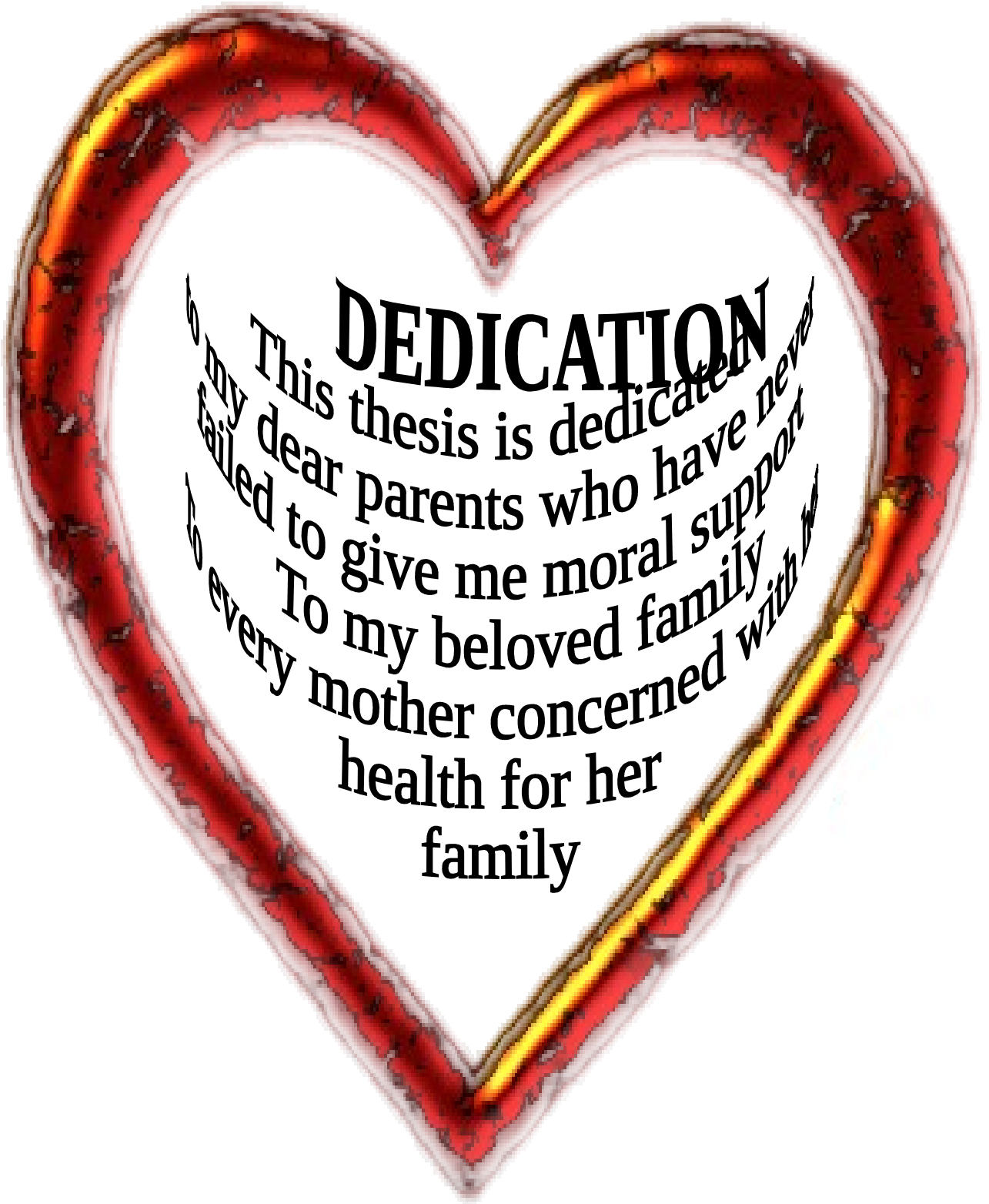


# Abstract

Magnetic Resonance Spectroscopy (MRS) and Diffusion Techniques (DWI) are currently being used more extensively than conventional Magnetic Resonance Imaging (MRI) in diagnosing lesions, therefore the main objective of this study was to evaluate the accuracy of MRS and DWI in characterization of female breast cancer. The data was collected from 100 patients with breast lesions in Saudi German Hospital using MRS and DWI. MRI was performed using a 1.5-T system (Magnetom symphony 1.5 Tesla, Siemens-Germany). For Magnetic Resonance Spectroscopy a Single-voxel MRS (SVS) was applied using a Point-resolved Spectroscopy Sequence (PRESS). All patients underwent diffusion weighted images with b values, 500, 1,000, 1,500, 2,000, and 3,000  $s/mm^2$ . Apparent Diffusion Coefficient (ADC) values were generated automatically through soft-ware system. If a high-signal-intensity lesion was detected in high-b-value ( $b = 3,000 s/mm^2$ ) images, that lesion was defined as malignant. We observed that the signal-intensity of benign lesion disappeared in the high-b-value ( $b = 3,000 s/mm^2$ ) and continue in brightness in case of malignant. The ADC values of the mass was calculated from two different gradient factors ( $b_1 = 500 s/mm^2$  and  $b^2 = 1,500 s/mm^2$ ) for positive results. For the in vivo MRS studies, each spectrum was evaluated for the presence of choline based on consensus reading, the results of this study showed that the sensitivity, specificity and accuracy of MRS were 100%, 90% and 93% respectively. For DWI, lesions with ADC values ( $> 1.5 mm^2/s$ ) were considered benign where as lesions with ADC values ( $< 1 mm^2/s$ ) were considered malignant, those lesions with ADC values ( $\geq 1 - < 1.5 mm^2/s$ ) represented the overlap cases (between benign and malignant). This method of using ADC values for the detection of malignant lesions showed a sensitivity, specificity and accuracy of 96%, 86% and 89% respectively. In conclusion MR spectroscopy was useful for characterizing breast lesions measuring 1.5 cm or larger and

diffusion-weighted imaging was useful for characterizing small and large lesions despite of overlap in some cases.

الفحص بالتحليل الطيفي المغناطيسي (MRS) وتقنية الإنتشار المغناطيسي (DWI) تستخدم حاليا على نطاق واسع أكثر من التصوير بالرنين المغناطيسي التقليدي (MRI) في تشخيص الآفات، ولذلك فإن الهدف الرئيسي من هذه الدراسة هو تقييم دقة الفحص بالتحليل الطيفي المغناطيسي وتقنية الإنتشار المغناطيسي في تشخيص أورام الثدي في الإنث. وقد تم جمع البيانات من 100 مريض يعانون من آفات الثدي في مستشفى السعودي الألماني باستخدام MRS و DWI. تم إجراء التصوير بالرنين المغناطيسي باستخدام نظام (Magnetom سيمفونية 1.5 تسلا، سيمنز، ألمانيا). لمطابافية الرنين المغناطيسي تم تطبيق MRS أحادية فوكسل (SVS) باستخدام نقطة حل تسلسل التحليل الطيفي (PRESS). ولقد خضع جميع المرضى لتقنية الإنتشار مع القيم - ب ( $s/mm^2$  1.000،  $s/mm^2$  500،  $s/mm^2$  2.000، 1.500، و  $s/mm^2$  3.000). وقد تم توليد إنتشار معامل (ADC) تلقائيا من خلال نظام القيم لينة وير. و كان إذا تم الكشف عن الآفة عالية الكثافة في إشارة القيمة العالية ب ( $b = 3000 s/mm^2$ )، تم تعريف الآفة بالخبثية. لاحظنا أن إشارة شدة الآفة الحميدة اختفت في القيمة العالية ( $b = 3000 s/mm^2$ ) والإستمرار في السطوع في حالة الآفة الخبثية. تم حسب القيم ADC من كتلة اثنين من العوامل المختلفة التدرج ( $b_1 = 500 s/mm^2$  and  $b^2 = 1,500 s/mm^2$ ) من أجل تحقيق النتائج الإيجابية. بالنسبة للفحوصات بتقنية التحليل الطيفي المغناطيسي (MRS)، كل طيف تم تقييمه على أساس وجود الكولين بناء على إجماع القراءة، وأظهرت نتائج هذه الدراسة أن حساسية، و نوعية ودقة MRS كانت 100٪، 90٪ و 93٪ على التوالي. بالنسبة للتشخيص بوساطة تقنية الإنتشار المغناطيسي (DWI)، الآفات مع القيم ( $> 1.5 mm^2/s$ ) ADC اعتبرت حميدة، بينما اعتبرت الآفات مع القيم ( $< 1 mm^2/s$ ) ADC آفات خبثية، أما القيم  $< 1 mm^2/s$  كانت تمثل حالات تداخل (بين الحميدة والخبثية). وأظهرت نتائج هذه الدراسة أن حساسية، و نوعية ودقة (DWI)، باستخدام القيم ADC كانت 96٪، 86٪ و 89٪ على التوالي. وفي الختام كان التحليل الطيفي (MRS) مفيدا لتمييز آفات الثدي التي حجمها 1.5 سم أو أكبر وتقنية الإنتشار المغناطيسي (DWI) كانت مفيدة لتشخيص الآفات الصغيرة والكبيرة الحجم على الرغم من التداخل في بعض الحالات.



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# Abbreviations

<b>MRI</b>	Magnetic Resonance Imaging
<b>MRS</b>	Magnetic Resonance Spectroscopy
<b>MRSI</b>	Magnetic Resonance Spectroscopy Imaging
<b>DCE</b>	Dynamic contrast enhanced
<b>ADC</b>	Apparent diffusion coefficient
<b>Cho</b>	Choline
<b>ADC</b>	Apparent Diffusion Coefficient
<b>DCIS</b>	Ductal carcinoma in situ
<b>LCIS</b>	Lobular carcinoma in situ
<b>IDC</b>	Invasive (infiltrating) ductal carcinoma
<b>ILC</b>	Invasive (infiltrating) lobular carcinoma
<b>FFDM</b>	Full Field Digital Mammography
<b>U/S</b>	Ultrasound
<b>QUS</b>	Quantitative ultrasound
<b>DCE</b>	Dynamic contrast enhanced
<b>DWI</b>	Diffusion weighted imaging
<b><sup>1</sup>H</b>	Proton Hydrogen
<b>NAC</b>	Neoadjuvant chemotherapy
<b>CSI</b>	Chemical shift imaging
<b>3D</b>	Three dimensions
<b>2D</b>	Two dimensions
<b>ppm</b>	Part per million
<b>SVS</b>	Single Voxel Spectroscopy
<b>PRESS</b>	Point-RESolved Spectroscopy
<b>STEAM</b>	STimulated Echo Acquisition Mode
<b>CHESS</b>	CHEmical Shift Selective
<b>FLAIR</b>	Fluid attenuated inversion recovery
<b>STIR</b>	Short tau inversion recovery
<b>WEFT</b>	Water Elimination Fourier Transform
<b>EPI fs</b>	Echo planar imaging fat saturated
<b>BI-RADS</b>	Breast imaging reporting and data system
<b>ADC</b>	Apparent Diffusion Coefficient
<b>PMRS</b>	proton magnetic resonance spectroscopy

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