A Comparison of Sonographic Image Quality between the Examinations using Gel and Olive Oil, as Sound Media

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Objective: *To compare the quality of real-time sonographic images obtained from the examinations using two different sound media, ultrasound gel and olive oil*
Material and Method: *A randomized controlled trial was conducted on the study population recruited from the routine ultrasound service with written informed consent. Each patient underwent scan using both ultrasound gel and olive oil as sound media, but only one media at a time. During each patient examination, the first type of sound media was randomly used and then followed by the other media. The sonographic images of the same plane were recorded as video clips for each type of sound media. The quality of images were blindly evaluated by one experienced sonographer, and the quality of ultrasound images was rated as 0 (very poor), 1 (poor), 2 (fair), and 3 (good), respectively.*
Results: *Of 346 cases (692 video clips), the image quality scores in ultrasound gel group and olive oil group were poor, fair, and good quality in 7, 182, and 157 and 9, 190, and 147 cases, respectively. The difference of quality scores between both groups was not statistically significant. (Chi square test; p = 0.687).*
Conclusion: *The quality of images obtained from the scan using olive oil is similar to that using ultrasound gel. Therefore, the olive oil may be used as alternative sound media for ultrasound examination. Furthermore, it could possibly be a preferred media because of its lower cost, pleasant smell, and it facility of cleaning.*

Keywords: *Olive oil, Ultrasound gel, Sound media*

J Med Assoc Thai 2007; 90 (4): 624-7
Full text. e-Journal: *http://www.medassocthai.org/journal*

In the recent years, ultrasonography becomes a widely useful imaging and most common use in pregnant women. About this imaging, the picture displayed on the screen is produced by sound waves reflected back from the imaged structures[1,2]. Sound media is one of the factors related to image quality. Poor quality media can result in an imperfect exam or misinterpretation as well as skin irritation. There are some reports of skin reaction from methylcellulose and propylene glycol in ultrasound gel[3-4]. Commercial standard ultrasound media is a water-soluble gel, expensive, and it is usually used in large amount for each examination. In Thailand, some doctors have experienced ultrasound examination using olive oil as sound media because of its low cost, good image quality, and pleasant smell, which most patients like. However, to the authors' best knowledge, based on the literature review on PUBMED, no study on image quality in ultrasound examination using olive oil has been reported.

Olive oil is the oil obtained solely from the fruit of the olive tree. It has pronounced antioxidant effects and containeds large proportions of vitamin A, D, K and vitamin E, which is the main source of protection against the free radical and is good for specific skin therapy such as acne, psoriasis, and dermatitis. Olive oil that is locally made in Thailand and is less expensive, of good quality, and a product promoted in northern Thailand. A lot of Thai people use olive oil for skin care especially in pregnant women who use olive oil to prevent striae gravidarum.

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The present study was a randomized, controlled trial to compare the quality of real time sonographic images obtained from the examinations using conventional ultrasound gel and olive oil.

Material and Method

The study population was recruited with written informed consent from the women attending at ultrasound unit, Department of Obstetrics and Gynecology, Faculty of Medicine, Chiang Mai University, Thailand, between May 1st 2006 and July 31st 2006. All of these women underwent trans-abdominal ultrasound examination with obstetric or gynecological indications on the basis of routine service. The patients with a history of allergy to olive oil would be excluded. The women were divided into two groups by randomization generated by computer. Group 1, used ultrasound gel followed by olive oil and group 2, which used olive oil followed by ultrasound gel. The reason for randomization into two groups was to prevent the effect of one sound media contaminating the other.

Ultrasound gel was obtained commercially, routine use in the hospital (AQUASONIC® 100 ULTRASOUND TRANSMISSION GEL .25 Liter Bottle) and olive oil was 100% concentration, use for skin application, made locally in Thailand. Ultrasound examinations were performed by two of the authors, using Voluson 730 pro (GE system, USA), or Medison medical ultrasound machine equipped with 3.5 MHz curvilinear transducers (Sonoace 8000, Korea). The trans-abdominal ultrasound examination was performed on the women in a supine position. The ultrasonographic images of the same plane were recorded as video clips for each type of sound media. The quality of images were blindly evaluated by one experienced sonographer, who had no information of the patients including sound media type, and the quality of ultrasound images was subjectively rated as score of 0-very poor, 1-poor, 2-fair, 3-good. Statistical analysis was performed by Chi-square test. A p-value < 0.05 was considered significant.

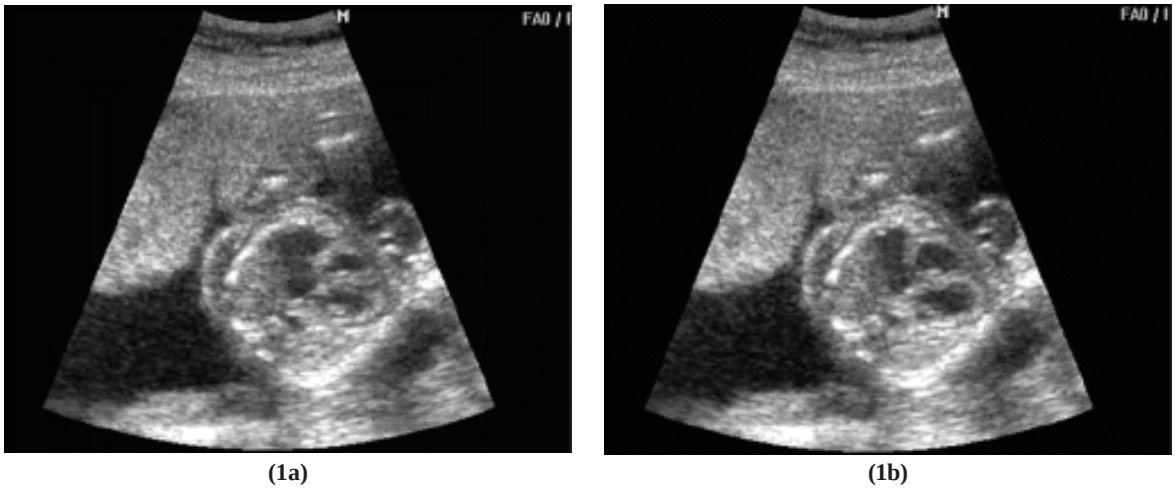
Results

Three hundred and forty-six women (692 video clips) were enrolled in the present study. The indications for ultrasonographic examination were obstetrics for 240 cases and gynecology for 106 cases. The quality scores for each groups is shown in Fig. 1.

The image quality scores in the ultrasound gel group were poor, fair, good quality in 7, 182, and 157 cases, respectively. In the olive oil group, the quality scores were 9, 190, and 147 cases, respectively. The difference of quality scores between both groups was not statistically significant (Chi-square test; $p = 0.687$) (Fig. 2).

Discussion

Surprisingly, olive oil has been widely used among women for skin care and some sonographers have used it as an alternative for sound media in cases of skin irritation or allergy to ultrasound gel in some patients, but there has been no control study to show



(1a) **(1b)**

Fig. 1 Example of 2 good quality images from the same patient obtained by using ultrasound gel (1a) compared to that obtained by using olive oil (1b)

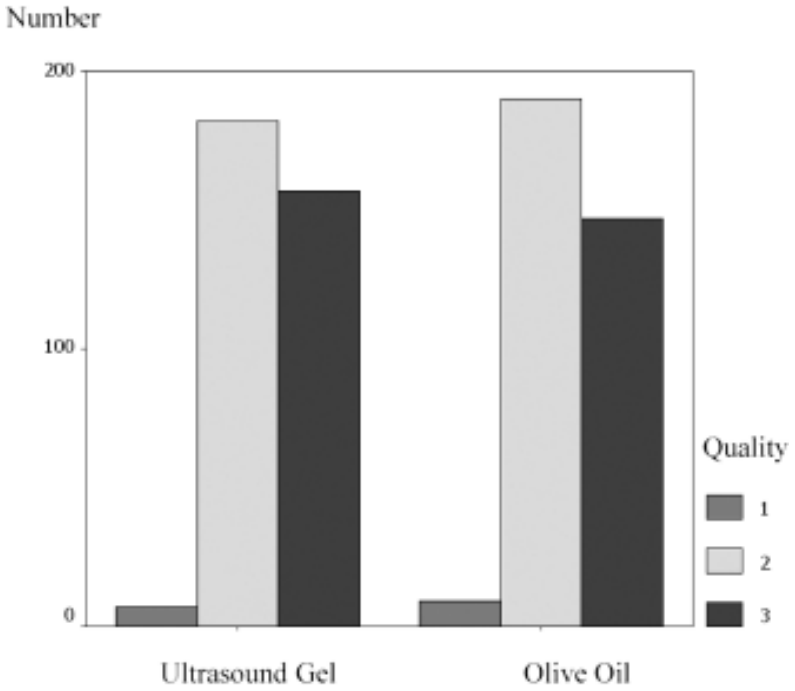


Fig. 2 Histogram shows frequency of image quality between the two groups

the effectiveness of olive oil for such a purpose. Olive oil can be simply used as sound media because of its property of water solubility and ability to conduct sound wave to specific tissue and back to the transducer creating the image on a screen. In the authors' experience, a chemical substance in ultrasound gel may cause irritation to normal skin in some women. This problem may also possibly occur with olive oil, however, the authors found no cases of allergy to olive oil in this study and no patient had to be excluded from the present study because of a previous history of allergy to olive oil.

Based on the results of the present study, there was no significant difference statistically in the image quality obtained using sound media of ultrasound gel or olive oil. This result is probably highly reliable due to several reasons as follows : 1) the present study had a large sample size. 2) the images for evaluation were recorded as video clips or real time images, which was theoretically better than static images or photographs, in which the quality of printing paper, printers, or color change with time can affect. Therefore, the quality or records should not be a problem. 3) apart from the nature of randomized control study, self-control by using both sound media on the same patients could eliminate several confounding factors between two groups such as abdominal wall thickness, different tissue types, or the emptiness of the bladder, etc. This is because these confounders would be the same between the two groups. 4) the image quality was blindly interpreted by the same sonographer who had no clinical information including the type of media used.

The weak point of the present study is that the image quality interpretation depended on one sonographer and quality score is subjectively evaluated. There was no standard quality score in evaluation of images. Furthermore, in pregnancy, fetal movement will affect the quality of images. However, the authors believe that this movement factor had only little effect on the reliability of the present study. Other limitations of the present study include 1; the image quality in transvaginal ultrasound examination has not been tested, 2; the possible negative effect of olive oil on ultrasound transducer over a long period has not yet been determined.

Most of the quality score is in fair and good, 182, 157 and 190, 147 in using ultrasound gel and olive oil respectively. Therefore, the result of the present study suggests that olive oil, which is a natural product containing vitamins, can be used as an alternative to ultrasound gel in obstetric and gynecological ultrasound examination.

Moreover, the patient's opinion on using both types of media indicated that olive oil could be more easily removed and cleaned on both the abdomen and clothes after examination. Another advantage is that the olive oil needless in amount. Several patients showed a favor of the pleasant smell of olive oil. The cost of olive oil media was much less than ultrasound gels. However, the authors do not know enough about long-term effect of olive oil on the ultrasound probe.

In conclusion, the quality of images obtained from the scan using olive oil is similar to that using ultrasound gel. Therefore, the olive oil may be used as an alternative sound media for ultrasound examination and may possibly be a preferred media due to its lower cost, easier clean-up, and pleasant smell.

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การเปรียบเทียบคุณภาพของภาพอัลตราซาวด์ระหว่างการใช้เจลอัลตราซาวด์กับน้ำมันมะกอกเป็นสื่อนำเสียง

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วัตถุประสงค์*: เพื่อศึกษาเปรียบเทียบคุณภาพของภาพอัลตราซาวด์จากการใช้สื่อนำเสียงที่แตกต่างกันระหว่างการใช้เจลอัลตราซาวด์และน้ำมันมะกอก*

รูปแบบการศึกษา*: การศึกษาวิจัยเชิงทดลองควบคุมแบบสุ่ม*

วัสดุและวิธีการ*: ผู้ป่วยหรือสตรีมีครรภ์ที่มีข้อบ่งชี้ในการส่งตรวจอัลตราซาวด์ทางสูติกรรมและนรีเวชกรรม ที่มารับบริการ ณ ห้องตรวจอัลตราซาวด์ โรงพยาบาลมหาราชนครเชียงใหม่ ทุกรายจะได้ทำอัลตราซาวด์โดยใช้สื่อนำเสียงทั้งสองชนิด โดยทำการสุ่มตัวอย่างเป็น 2 กลุ่มการศึกษา กลุ่มที่ 1 ใช้เจลอัลตราซาวด์ เป็นสื่อนำเสียงก่อนใช้น้ำมันมะกอก และ กลุ่มที่ 2 ใช้น้ำมันมะกอกเป็นสื่อนำเสียงก่อนการใช้เจลอัลตราซาวด์ ในการตรวจ ภาพอัลตราซาวด์จะถูกบันทึกไว้เป็นวิดีโอคลิป ซึ่งในการตรวจทั้งสองครั้งจะทำในระนาบเดียวกัน ภาพอัลตราซาวด์ทั้งหมดจะถูกประเมินคุณภาพโดยผู้เชี่ยวชาญเพียงท่านเดียว ซึ่งไม่ทราบว่าใช้สื่อนำเสียงชนิดใด โดยอาศัยเกณฑ์ดังนี้ คะแนน 0 ไม่เป็นที่น่าพอใจ, 1 พอใช้, 2 ดี, 3 ดีมาก*

ผลการศึกษา*: ในสตรี 346 ราย (692 วิดีโอคลิป) ในกลุ่มที่ใช้เจลอัลตราซาวด์ พบว่าคุณภาพของภาพอัลตราซาวด์ที่ได้คะแนน ไม่เป็นที่น่าพอใจ, พอใช้, ดี และดีมาก เป็น 0, 7, 182, 157 ราย ส่วนในกลุ่มที่ใช้น้ำมันมะกอก ได้ 0, 9, 190, 147 ราย ตามลำดับ พบว่าไม่มีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติของคุณภาพของภาพอัลตราซาวด์ในทั้งสองกลุ่ม*

สรุป*: คุณภาพของภาพอัลตราซาวด์จากการใช้น้ำมันมะกอกเป็นสื่อนำเสียง ใกล้เคียงกับการใช้เจลอัลตราซาวด์ ดังนั้นน้ำมันมะกอกจึงสามารถเป็นสื่อนำเสียงในการทำอัลตราซาวด์ ซึ่งมีราคาถูก และใช้ง่าย สะดวกต่อการเช็ดทำความสะอาด และมีกลิ่นเป็นที่น่าพอใจแก่ผู้มารับบริการอัลตราซาวด์*