



**XXV<sup>e</sup>**  
**Congrès de la**  
**Societat Catalana**  
**d'Endocrinologia**  
**i Nutrició**

Barcelona, 24 i 25 de novembre 2022

# Ecografía muscular per l'estudi de la sarcopenia

**Fiorella Palmas**  
Facultativa del servicio de Endocrinología y Nutrición  
del Hospital Universitario Vall D'Hebron.

# Funciones metabólicas del músculo

## MÚSCULO ESQUELÉTICO

### FUNCIONES ESTRUCTURALES

Movimiento corporal

Fuerza

Mantenimiento de postura y equilibrio



### FUNCIONES METABÓLICAS

Principal reservorio de proteínas

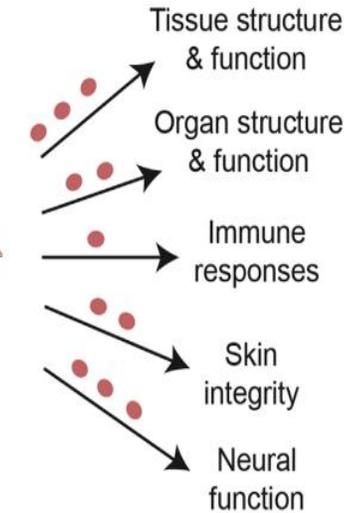
Síntesis y almacenamiento de glutamina

Regulador de los niveles de glucosa

### Malnourished state



Skeletal muscle



El músculo como **órgano metabólico-endocrino**

**Muy importante durante procesos patológicos**

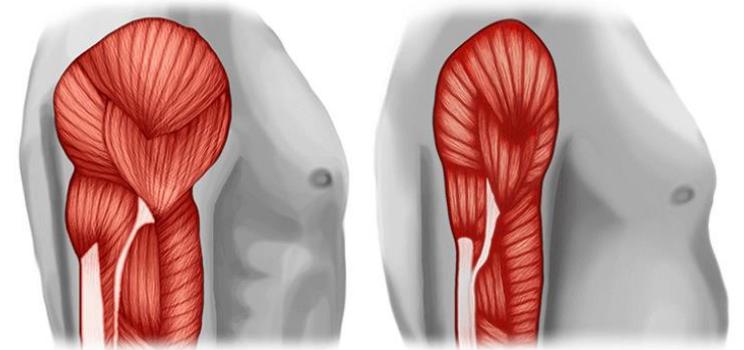
El déficit de MM deja al individuo sin un reservorio crucial para combatir la enfermedad, las infecciones y el desgaste.

# Sarcopenia

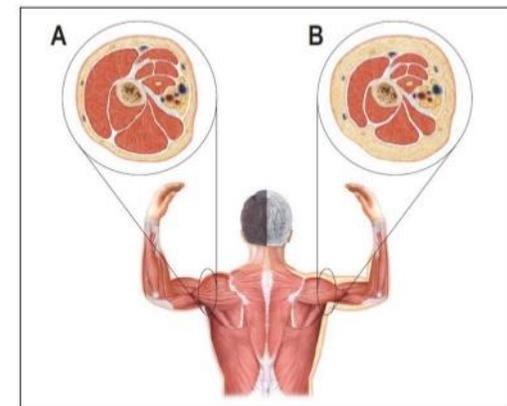
Síndrome complejo, que se caracteriza por la **pérdida de masa muscular esquelética (MME) y de la función de la misma.**

Definición European Working Group on Sarcopenia in Older People (EWGSOP).

**Obesidad sarcopénica:** pérdida de masa muscular esquelética (MME) y de la función + conjugación con un incremento de la masa grasa (MG).



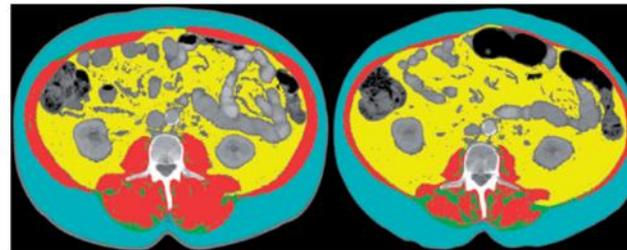
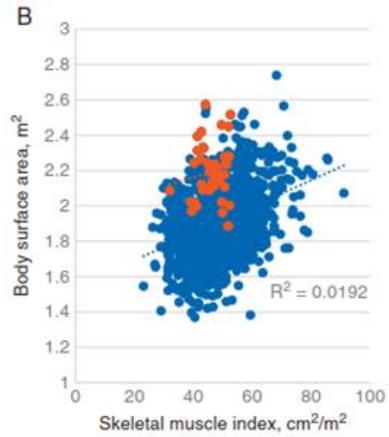
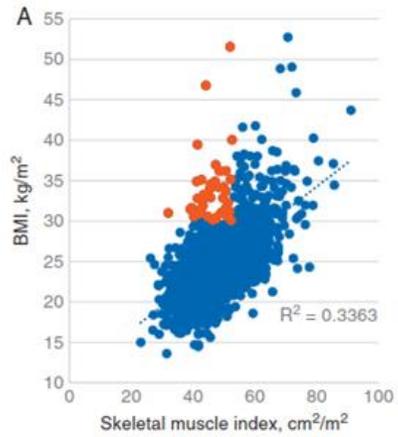
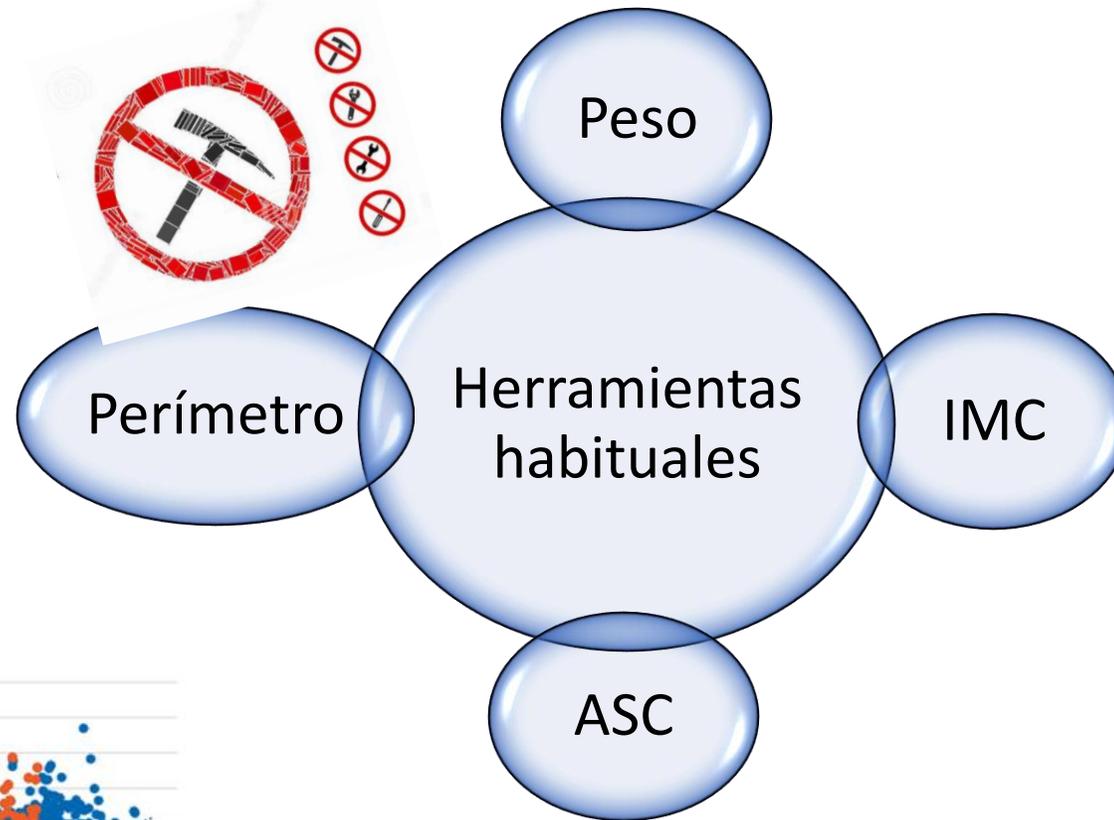
**Obesidad Sarcopénica.**



# Sarcopenia



# La imprecisión del IMC



# Valoración nutricional: GLIM



Contents lists available at ScienceDirect

Clinical Nutrition

journal homepage: <http://www.elsevier.com/locate/clnu>

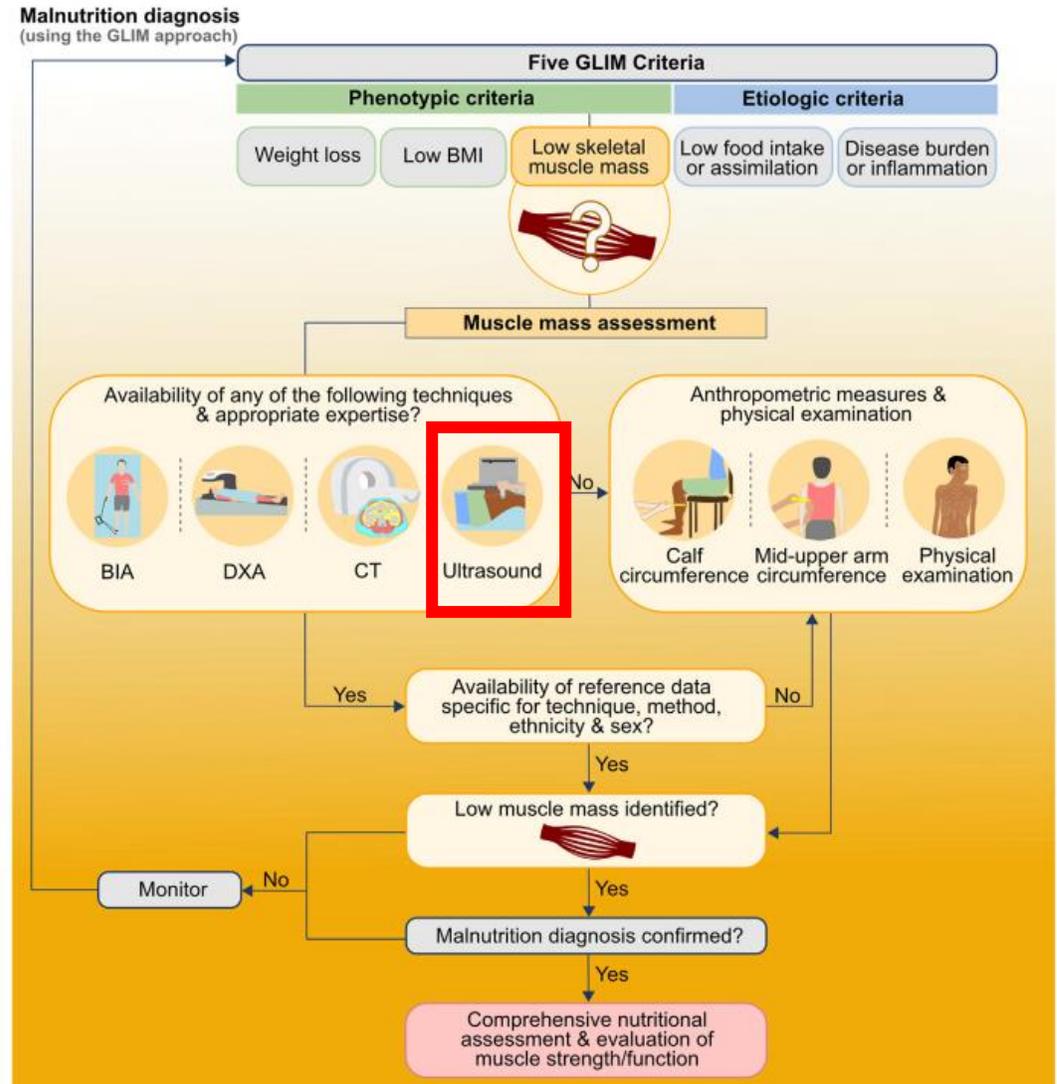


ESPEN Endorsed Recommendation

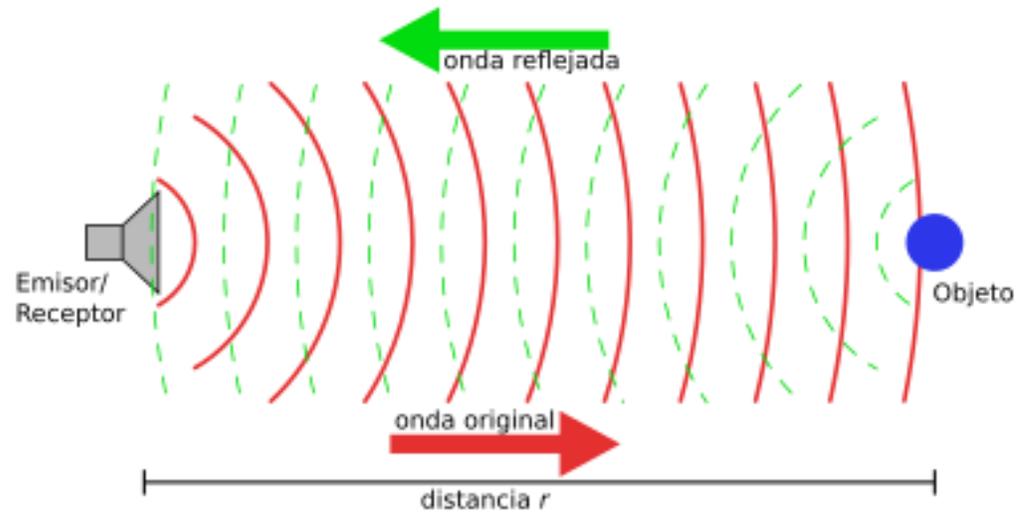
Guidance for assessment of the muscle mass phenotypic criterion for the Global Leadership Initiative on Malnutrition (GLIM) diagnosis of malnutrition<sup>☆</sup>

Rocco Barazzoni<sup>a,\*</sup>, Gordon L. Jensen<sup>b</sup>, Maria Isabel T.D. Correia<sup>c</sup>,  
 Maria Cristina Gonzalez<sup>d</sup>, Takashi Higashiguchi<sup>e</sup>, Han Ping Shi<sup>f</sup>, Stephan C. Bischoff<sup>g</sup>,  
 Yves Boirie<sup>h</sup>, Fernando Carrasco<sup>i</sup>, Alfonso Cruz-Jentoft<sup>j</sup>, Vanessa Fuchs-Tarlovsky<sup>k</sup>,  
 Ryoji Fukushima<sup>l</sup>, Steve Heymsfield<sup>m</sup>, Marina Mourtzakis<sup>n</sup>, Maurizio Muscaritoli<sup>o</sup>,  
 Kristina Norman<sup>p,q</sup>, Ibolya Nyulasi<sup>r,s,t</sup>, Veeradej Pisprasert<sup>u</sup>, Carla Prado<sup>v</sup>,  
 Marian de van der Schuren<sup>w,x</sup>, Sadao Yoshida<sup>y</sup>, Yanchun Yu<sup>z</sup>, Tommy Cederholm<sup>aa,ab</sup>,  
 Charlene Compher<sup>ac</sup>

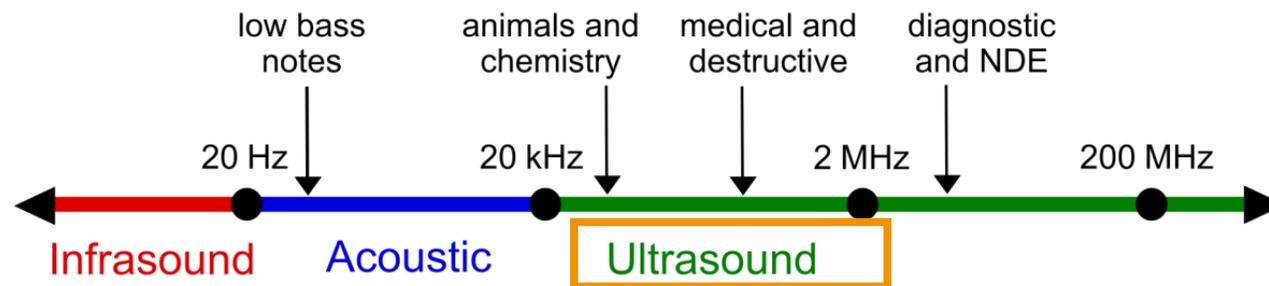
•**ESPEN, ASPEN:** recommend the **routine assessment of body composition** with specific emphasis on lean mass.



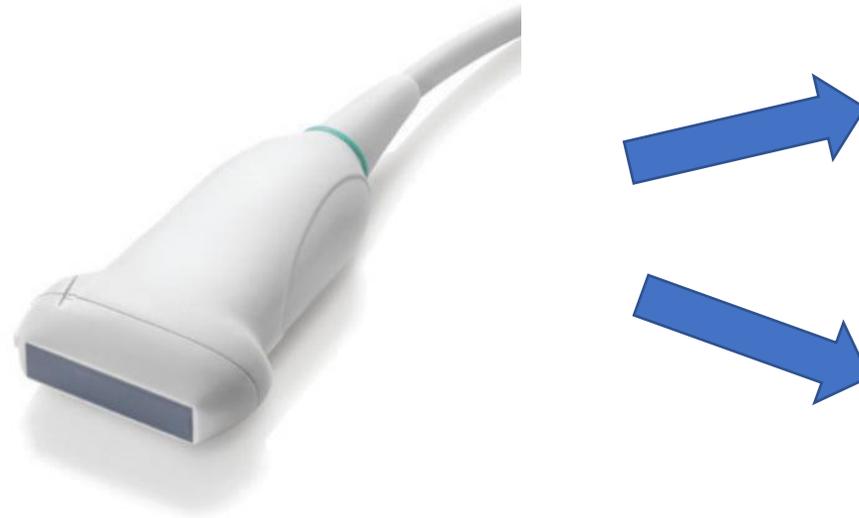
# Inocua



→ Técnica emergente, económica, portátil  
y no implica radiación ionizante.



# Accesible



- Utilizaremos transductores de matriz lineal de banda ancha, de alta frecuencia de 7.5 MHz a 15 MHz (mismo equipo que para la ecografía de tiroides).
- Musculo: 7.5-10 MHz.

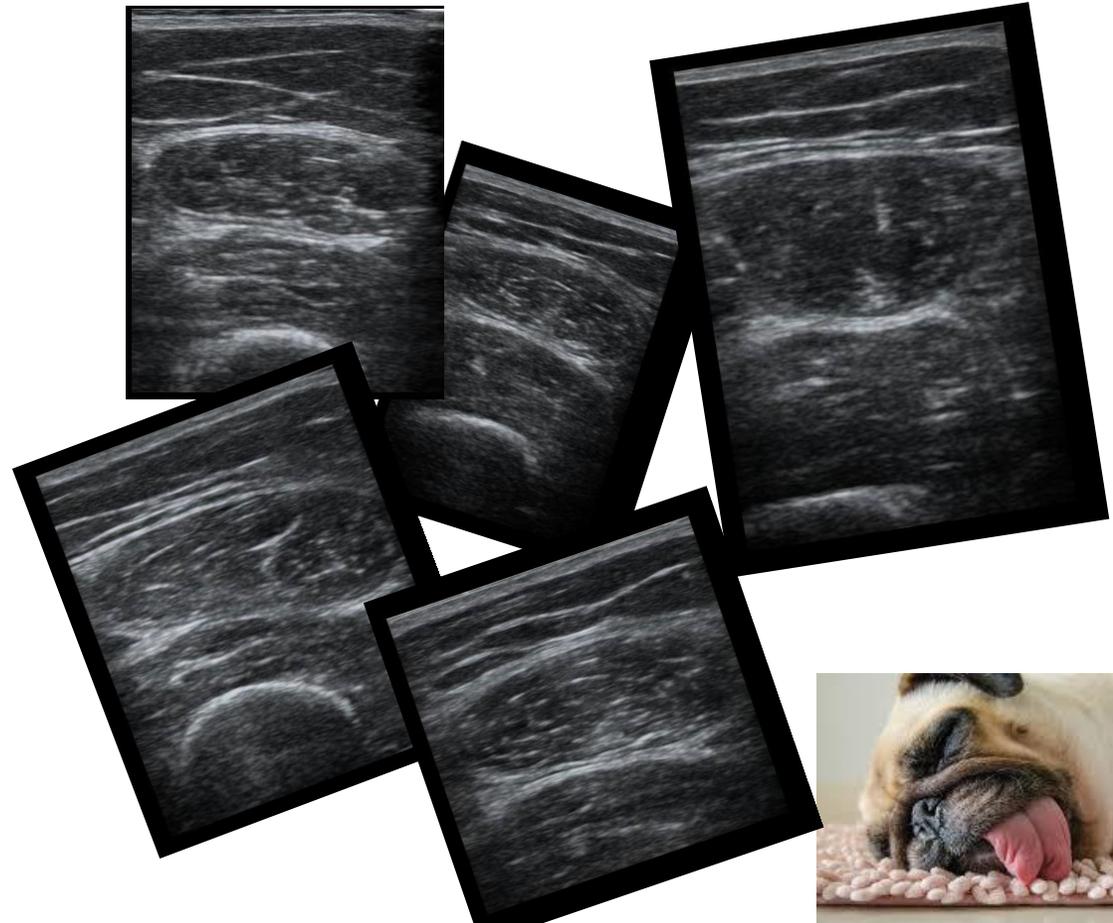
# Accesible

## Bedside

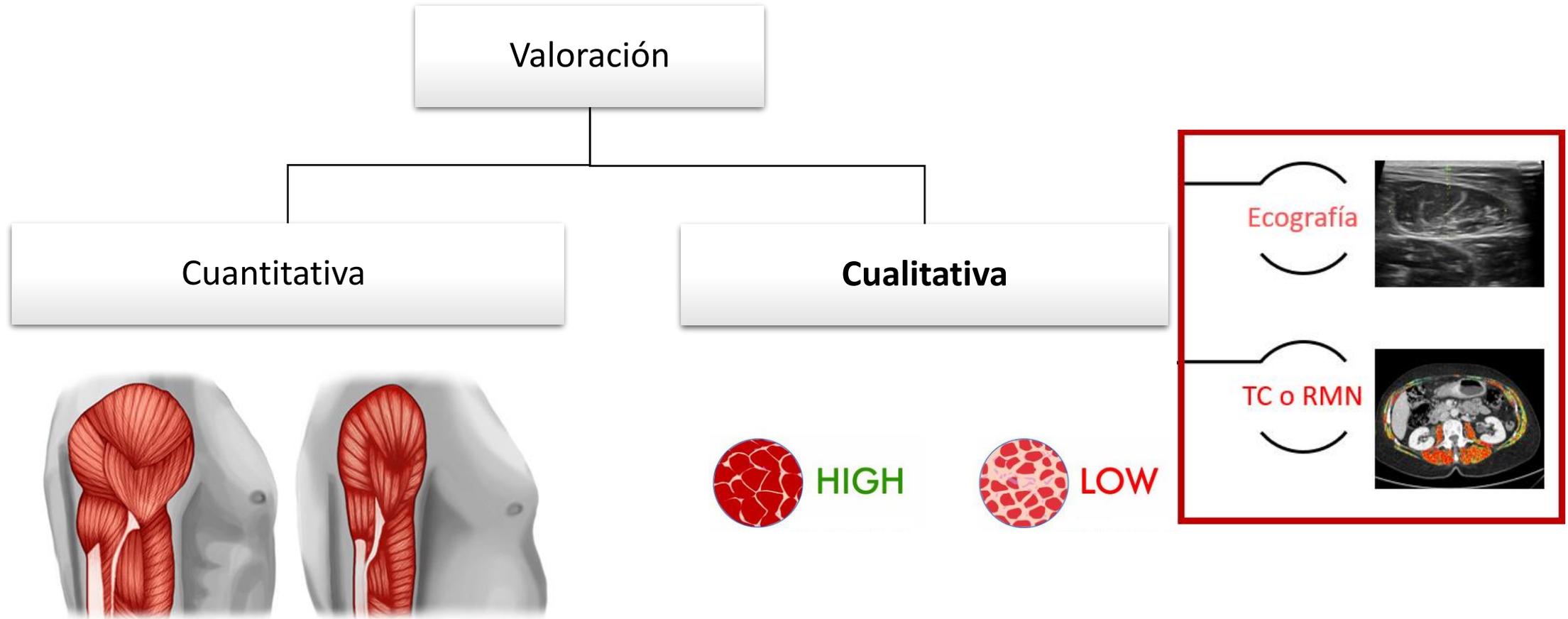
→ “Al lado de la cama”



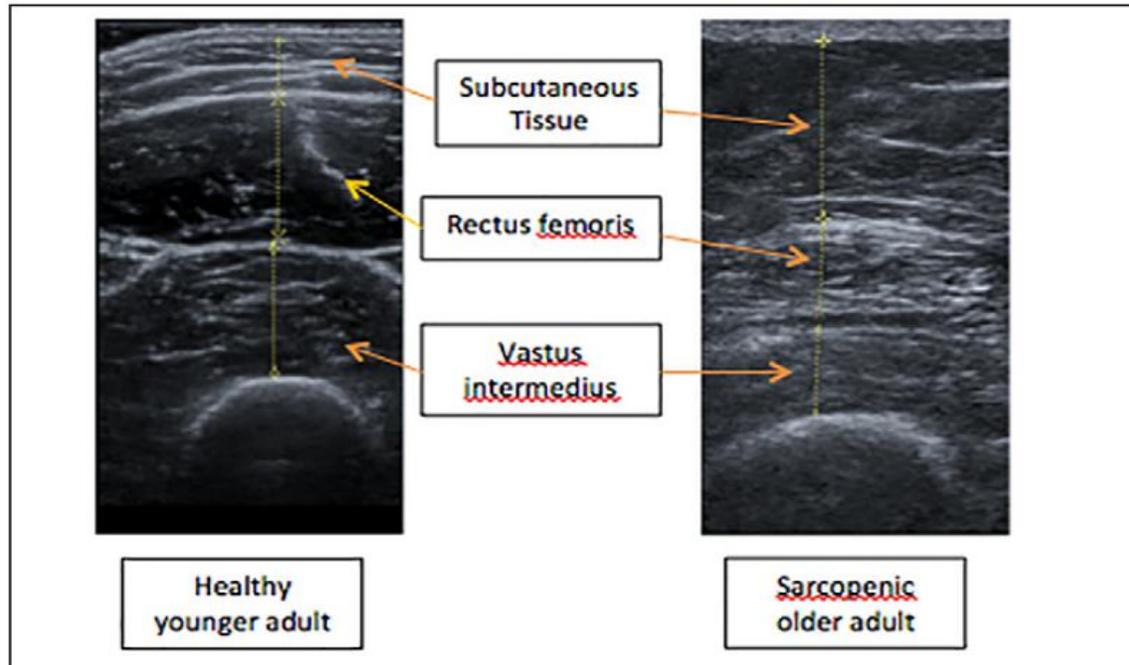
All you can



# Evaluación cualitativa



# Evaluación cualitativa



VALORACION CUALITATIVA:  
Escala de grises



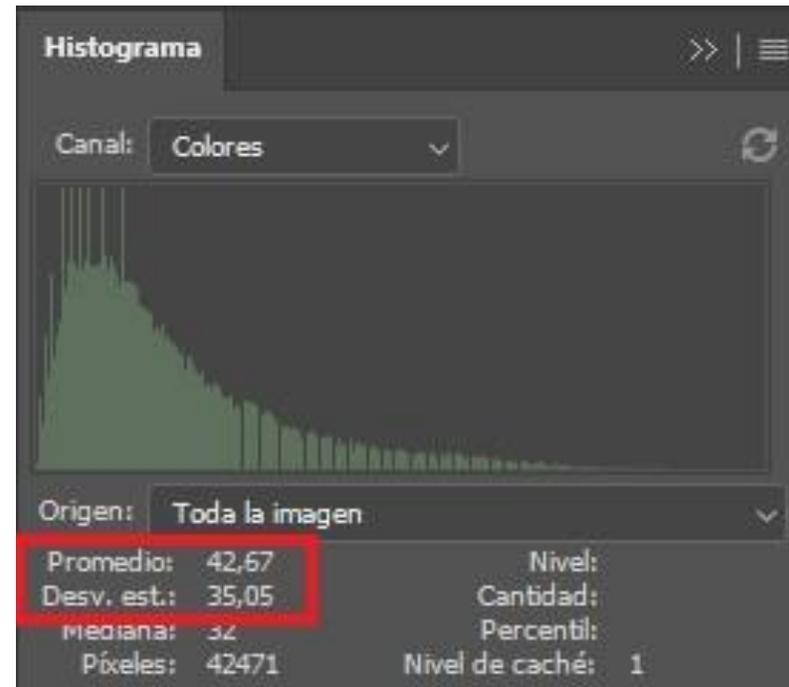
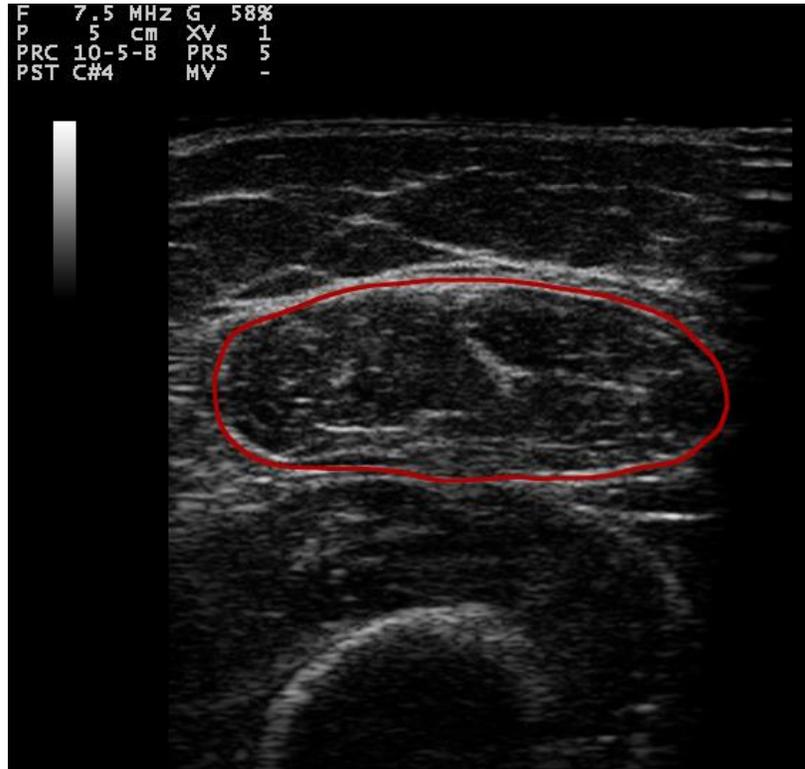
0

255

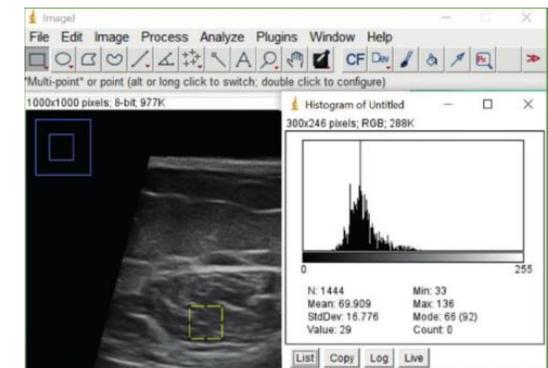


Pillen, S. et al. (2009). Quantitative gray-scale analysis in skeletal muscle ultrasound: A comparison study of two ultrasound devices. *Muscle and Nerve*, 39(6), 781–786

# Evaluación cualitativa



- Histograma del área del recto anterior con el programa Photoshop CC 2020.
- Otros: Image J



Let's do it!!



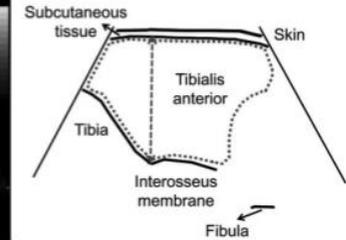
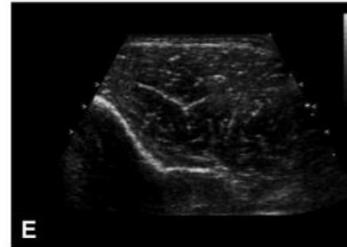
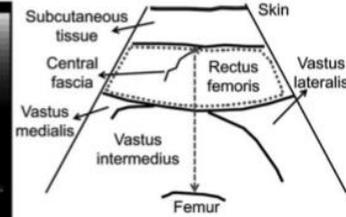
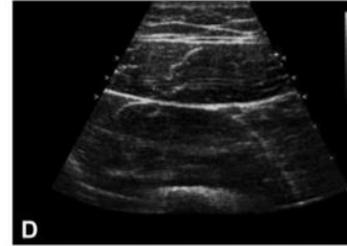
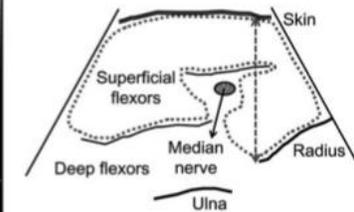
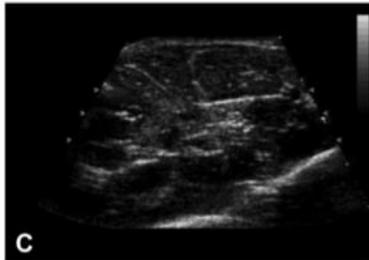
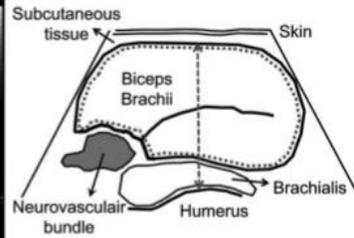
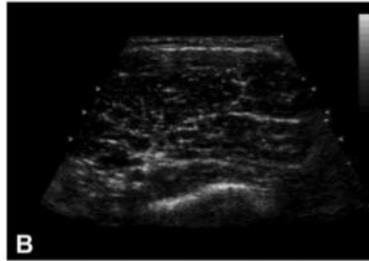
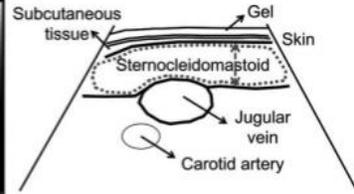
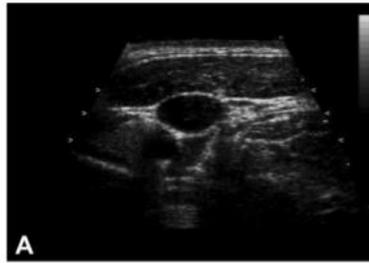
# NORMAL VALUES FOR QUANTITATIVE MUSCLE ULTRASONOGRAPHY IN ADULTS

ILSE M.P. ARTS, MD,<sup>1</sup> SIGRID PILLEN, MD,<sup>2</sup> H. JURGEN SCHELHAAS, MD, PhD,<sup>1</sup> SEBASTIAAN OVEREEM, MD, PhD,<sup>2</sup> and MACHIEL J. ZWARTS, MD, PhD<sup>2</sup>

<sup>1</sup>Neuromuscular Centre Nijmegen, Department of Neurology, Radboud University Nijmegen Medical Centre, Nijmegen, The Netherlands

<sup>2</sup>Department of Clinical Neurophysiology, Donders Institute for Brain, Cognition and Behavior, Radboud University Nijmegen Medical Centre, P.O. Box 9101, 6500 HB Nijmegen, The Netherlands

Accepted 26 May 2009



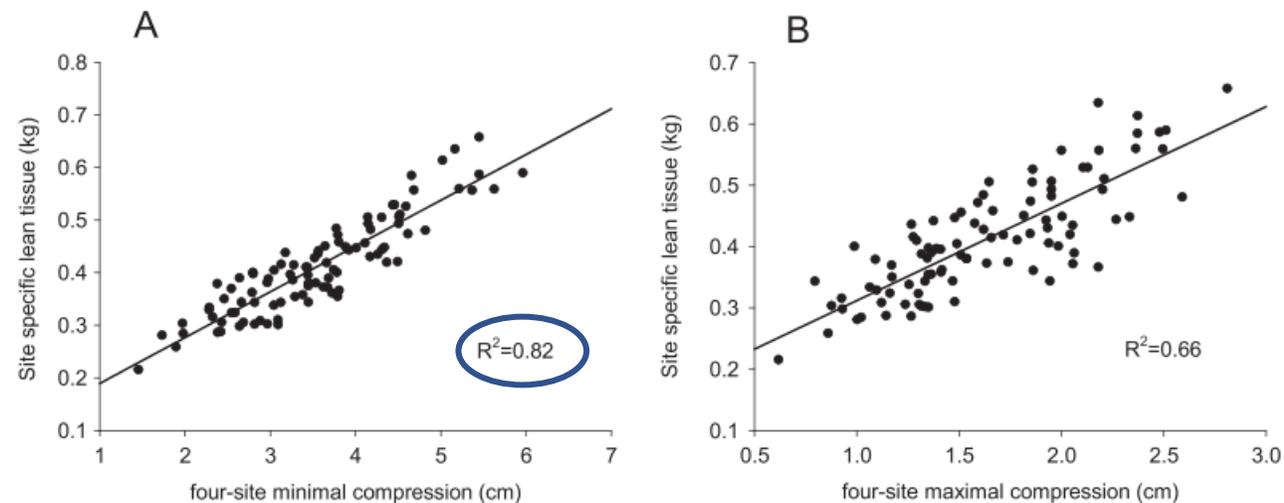
# Development of a bedside viable ultrasound protocol to quantify appendicular lean tissue mass

Michael T. Paris<sup>1</sup> , Benoit Lafleur<sup>1</sup>, Joel A. Dubin<sup>2,3</sup> & Marina Mourtzakis<sup>1\*</sup>

<sup>1</sup>Department of Kinesiology, University of Waterloo, Waterloo, Canada; <sup>2</sup>School of Public Health and Health Systems, University of Waterloo, Waterloo, Canada;

<sup>3</sup>Department of Statistics and Actuarial Science, University of Waterloo, Waterloo, Canada

**Figure 1** Regression analysis between site-specific lean tissue mass derived from DXA and the four-site ultrasound protocol using (A) minimal compression,  $R^2 = 0.82$ , and (B) maximal compression,  $R^2 = 0.66$ . DXA, dual-energy X-ray absorptiometry.



# Identificación de la zona a medir

Punto medio



1/3 inferior



**SEEN**

Sociedad Española de  
Endocrinología y Nutrición



Tabla de referencia de medidas

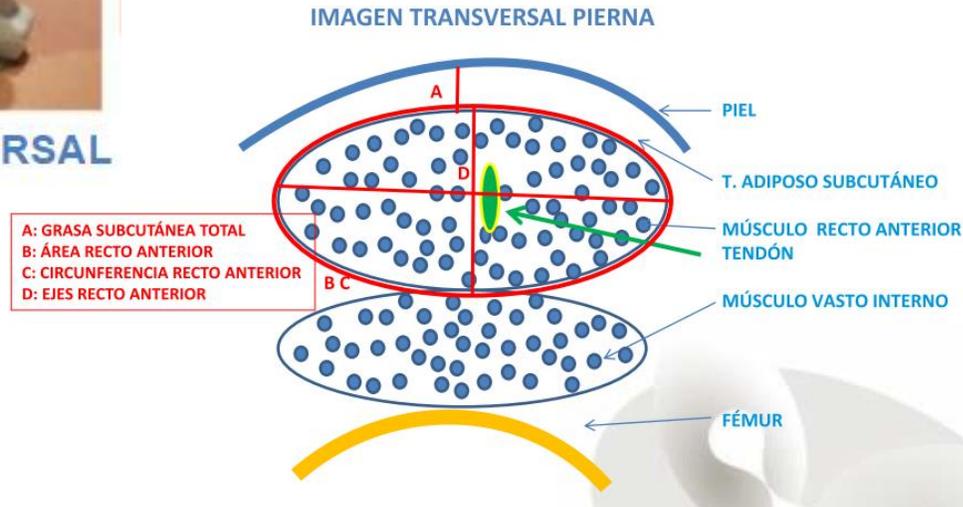
Cm	Cm/3
40	13
41	14
42	14
43	14
44	15
45	15
46	15
47	16
48	16
49	16
	17



# Identificación del músculo



TRANSVERSAL



2022-05-30 09:58:51  
MI: 0.9 TIS: 0.2  
GN: 81dB  
D: 60mm  
ENH: 2  
DR: 70  
F: H10.0 MHz



Congelar

# Identificación del músculo



LONGITUDINAL

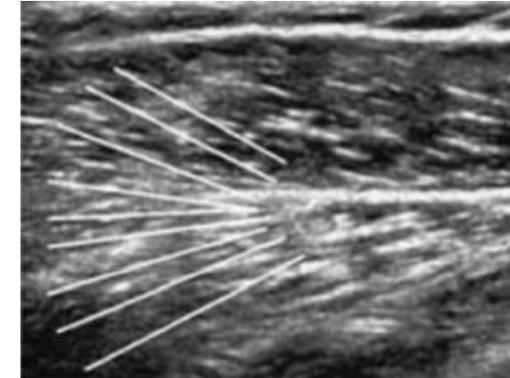
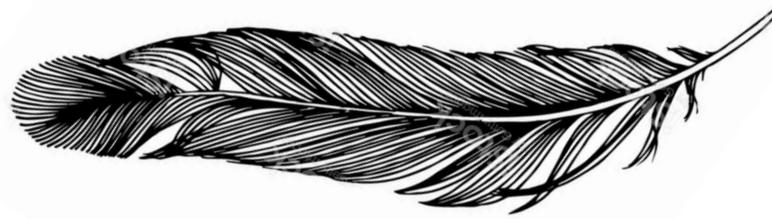
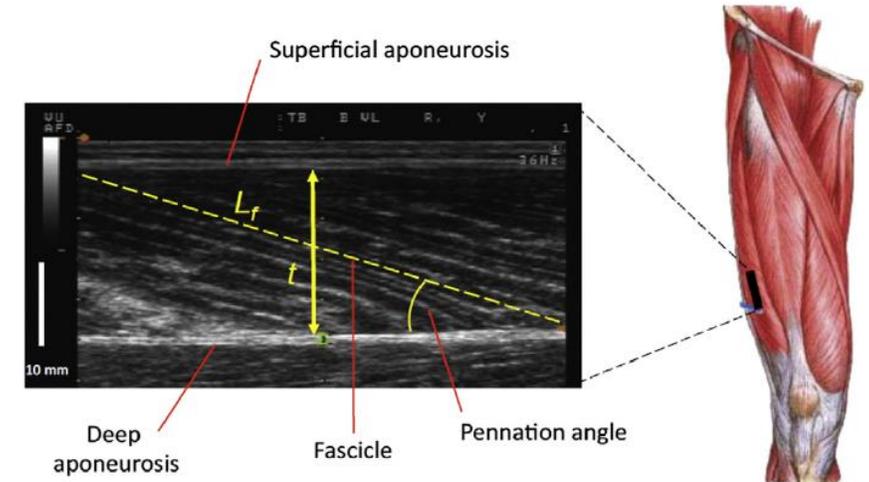


IMAGEN LONGITUDINAL PIERNA



A: GRASA SUBCUTÁNEA TOTAL  
B: EJE RECTO ANTERIOR



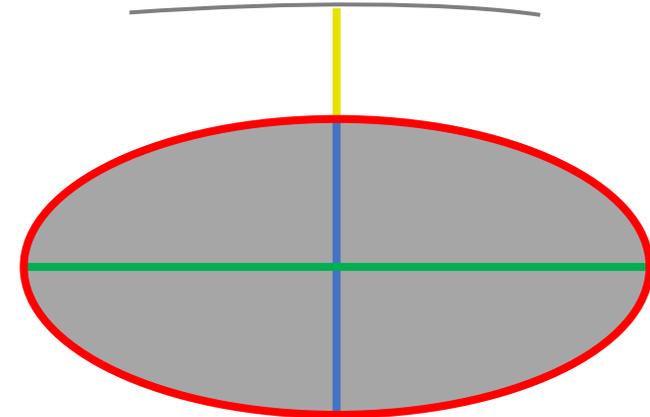
# Medición recto femoral



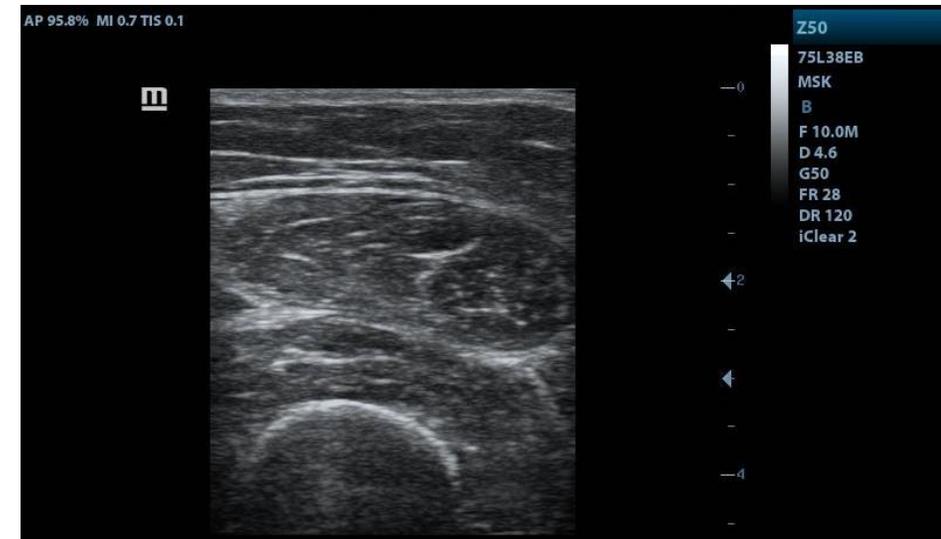
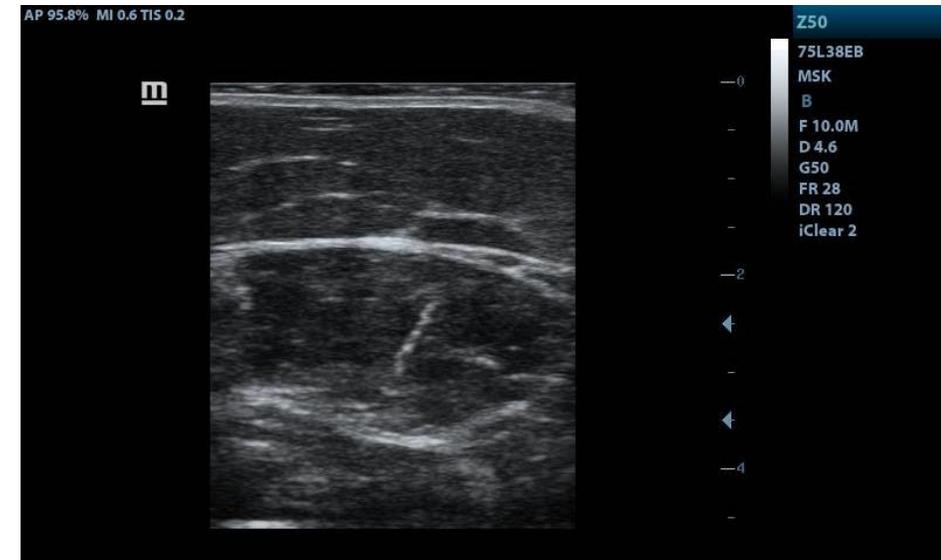
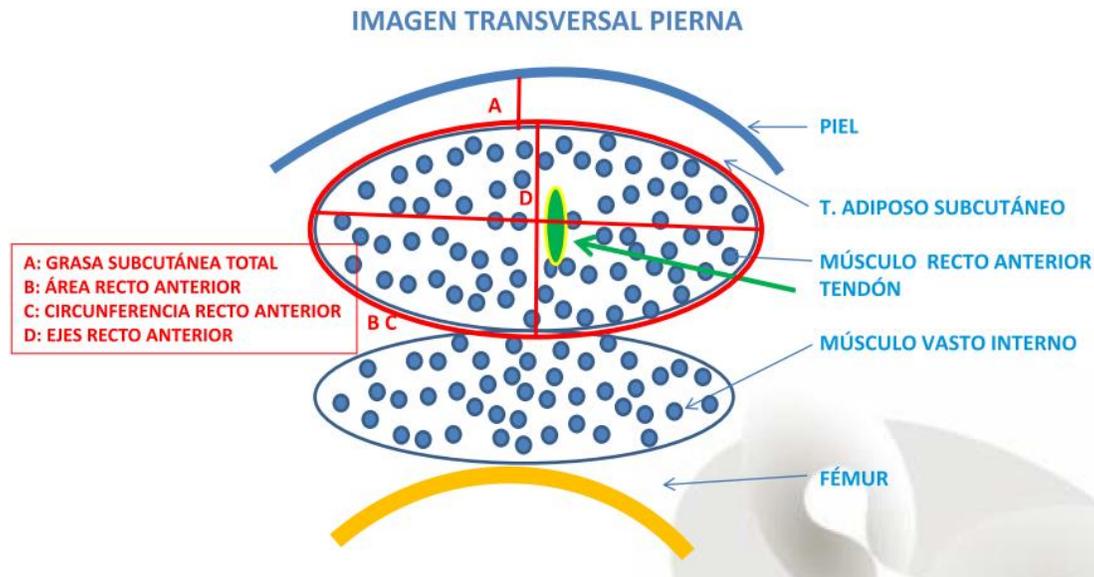
TRANSVERSAL



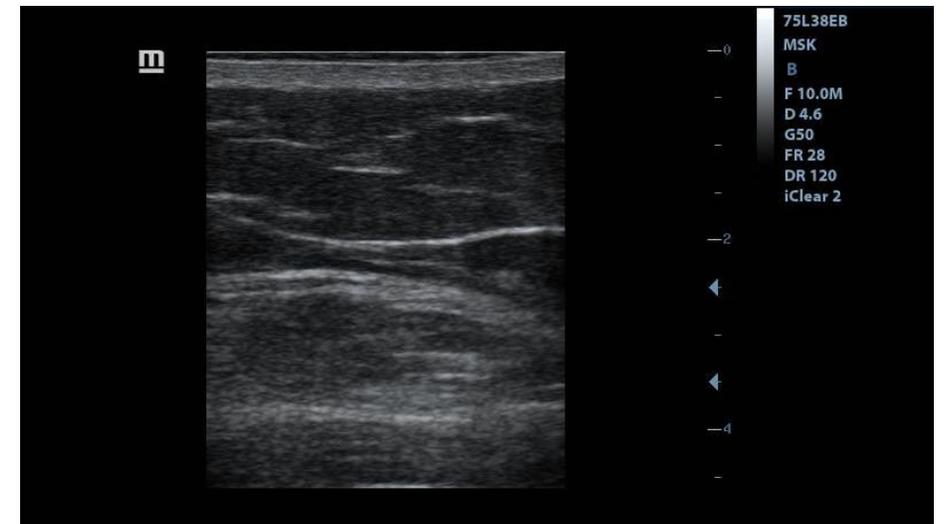
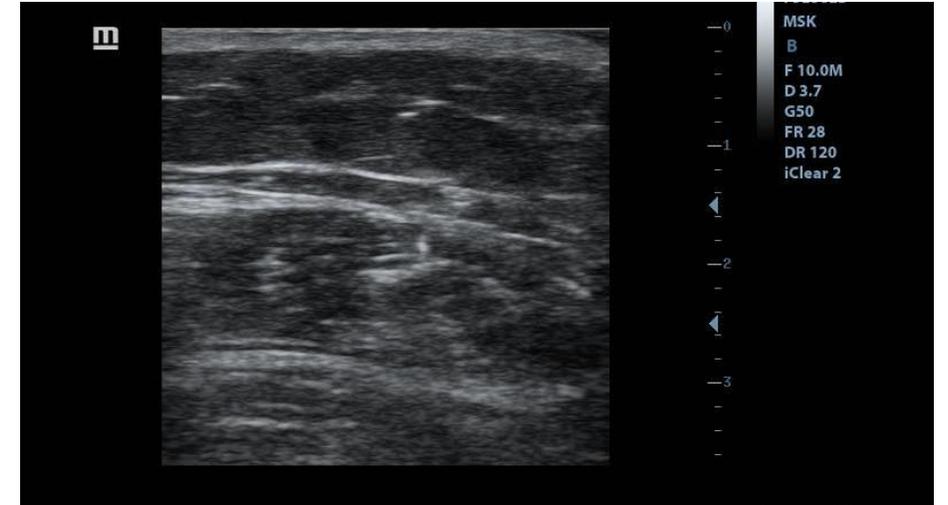
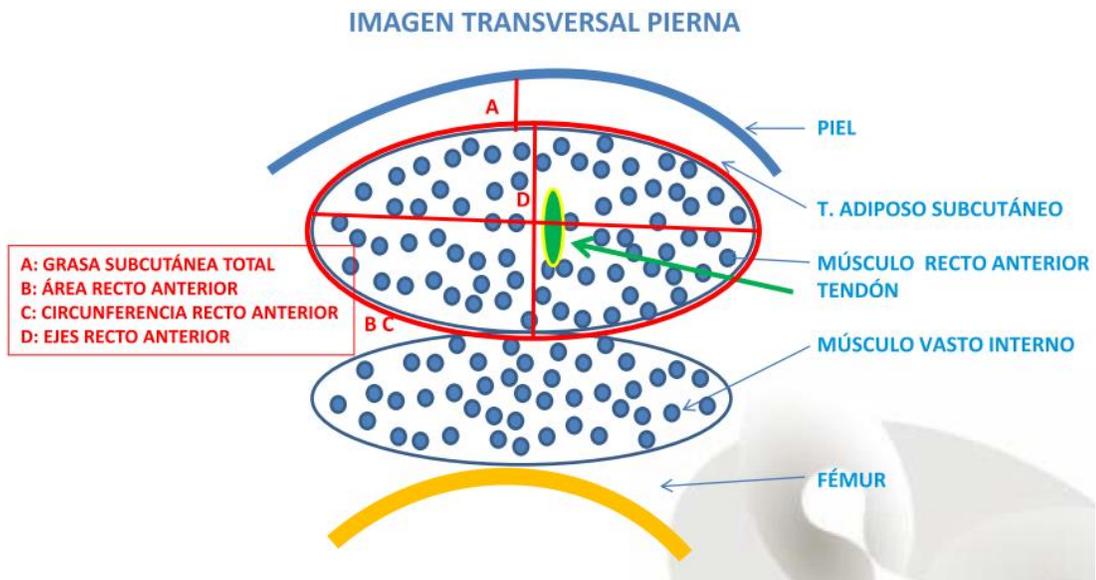
- Mediciones pierna:
  - Punto de medición (cm)
  - Tejido adiposo (cm)
  - Eje Y (cm)
  - Eje X (cm)
  - Area y/o circunferencia (cm<sup>2</sup>)



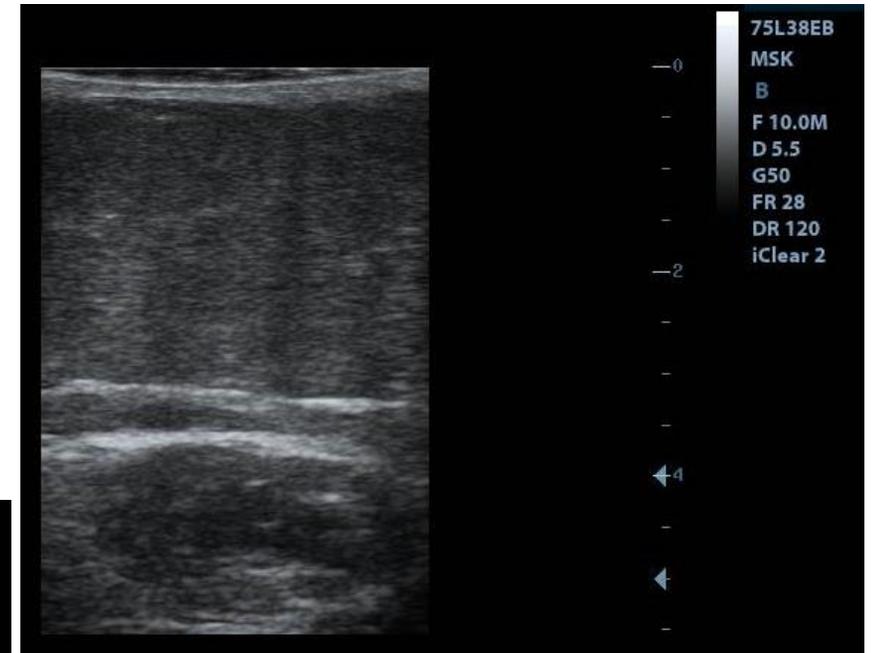
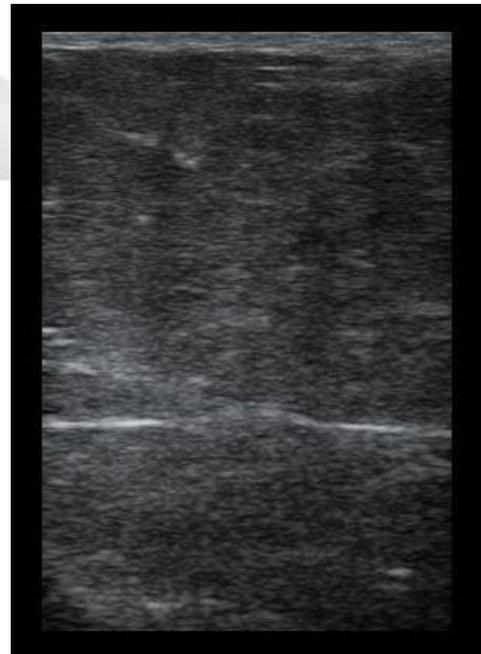
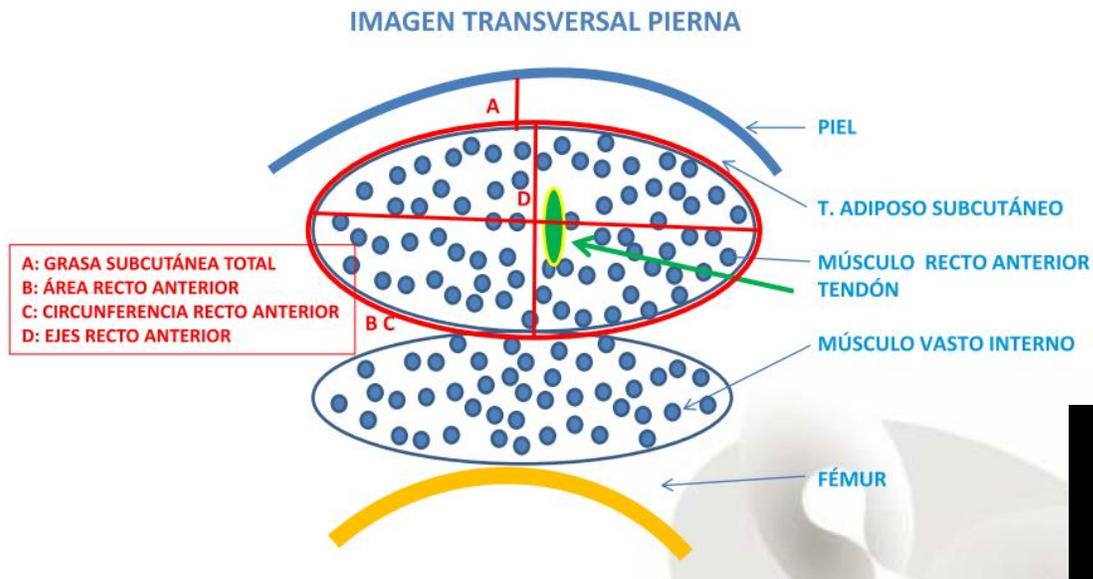
# Identificación del músculo: nivel 1



# Identificación del músculo: nivel 2



# Me conformo con encontrar el recto



# EXPECTATIONS

vs.

# REALITY

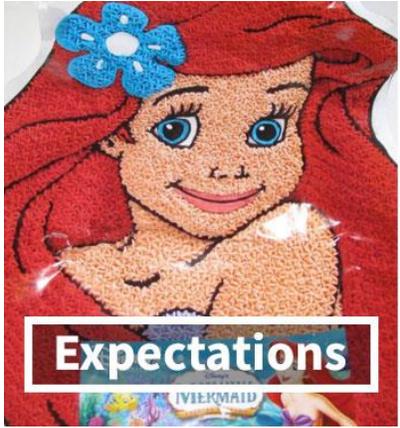
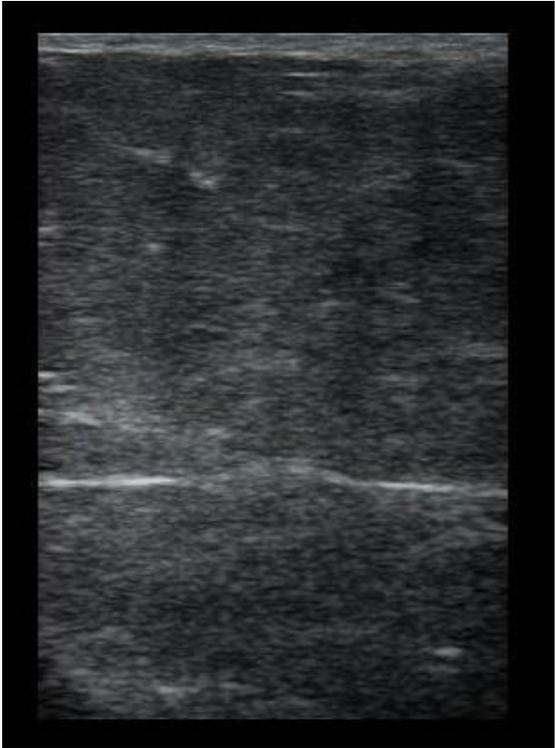
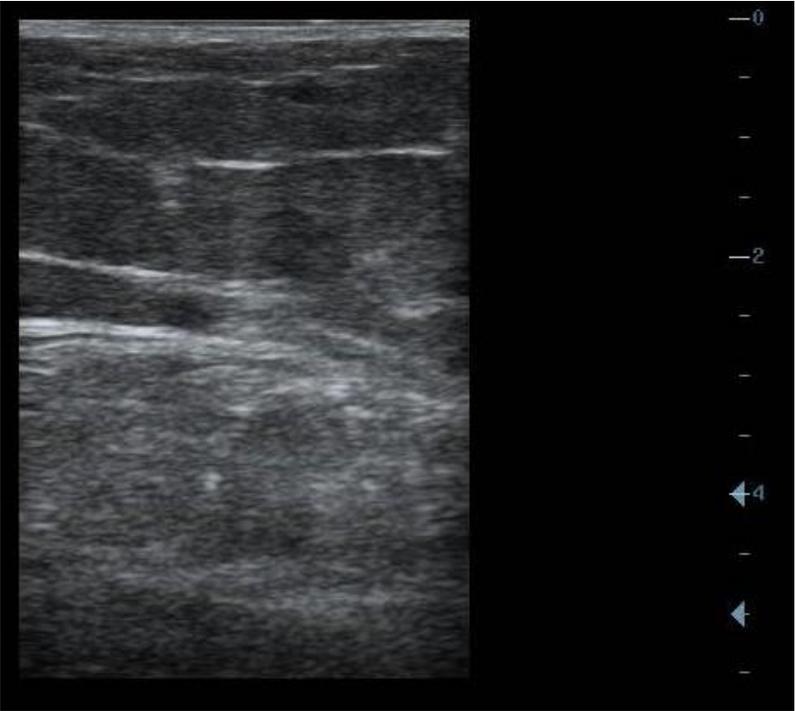
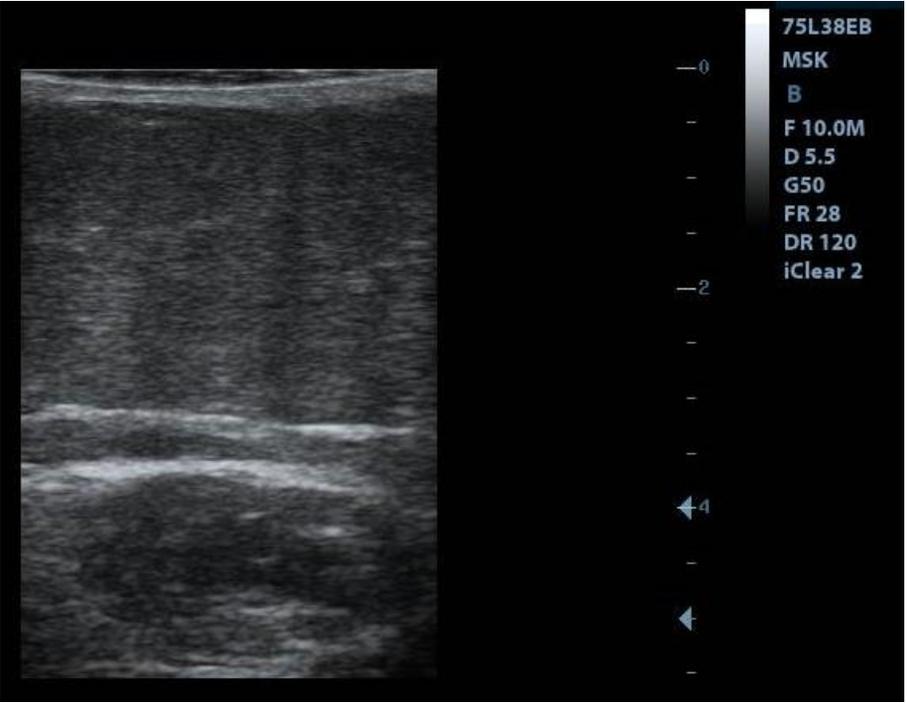
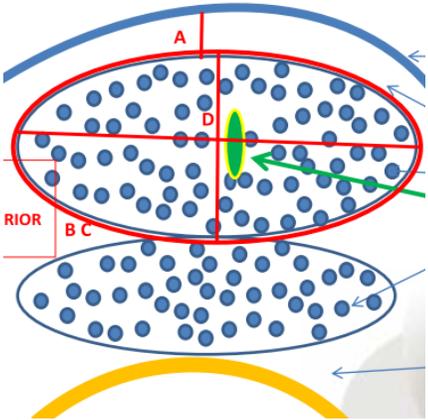
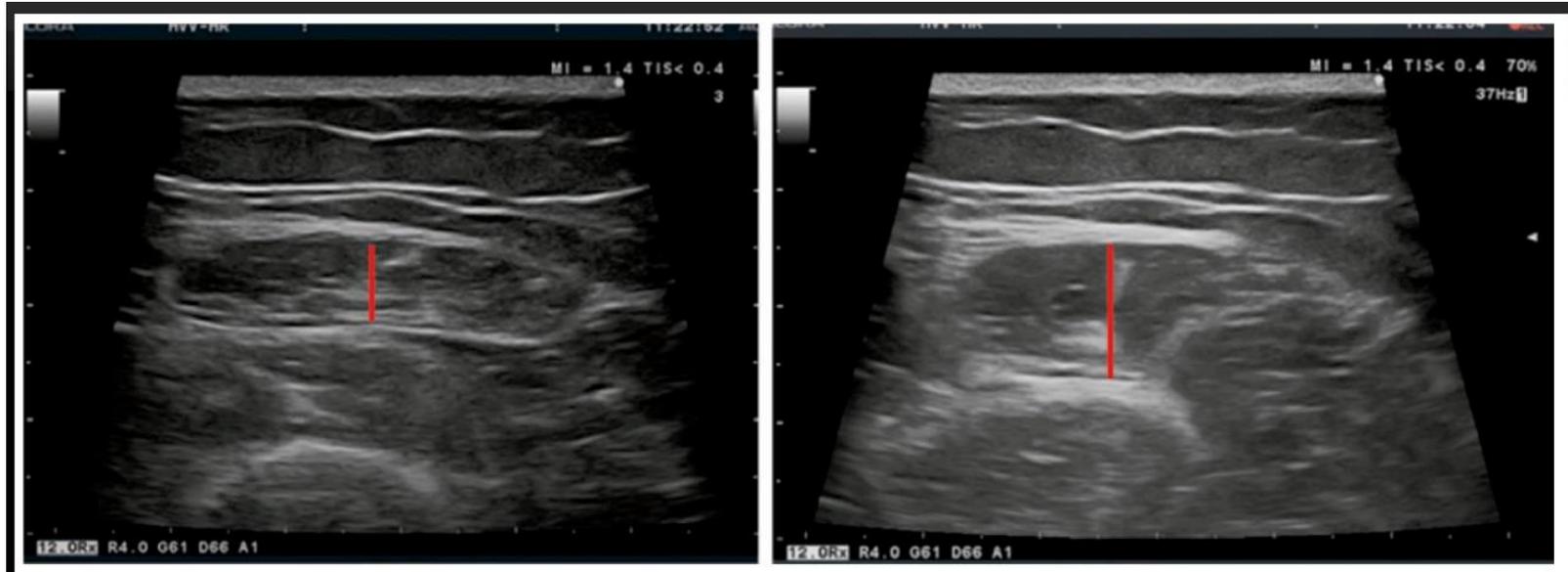


IMAGEN TRANSVERSAL PIERNA





# Valoración tejido adiposo abdominal

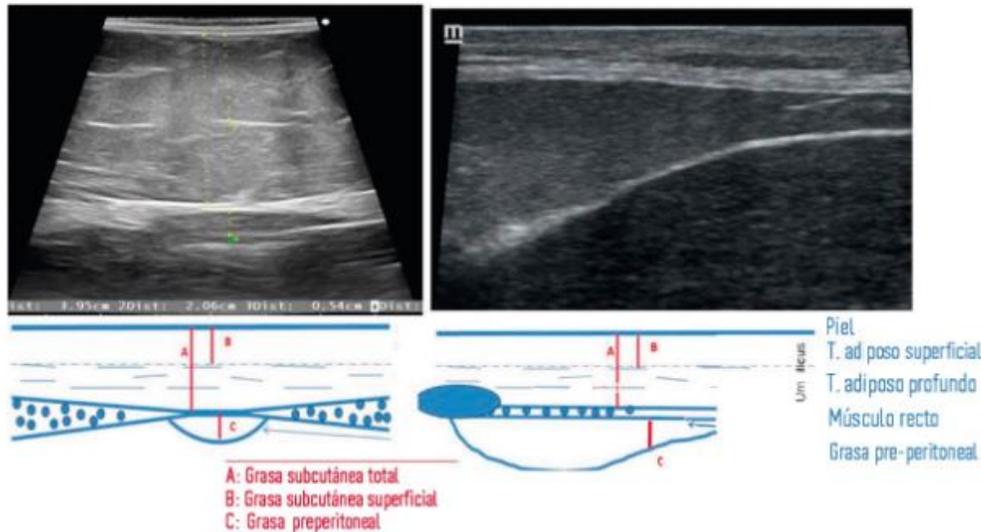
## ÁREA ABDOMINAL



TRANSVERSAL



LONGITUDINAL



Evaluar la **distribución grasa**:

- TA subcutáneo superficial: reserva energética
- TA subcutáneo profundo: regulación neuroendocrina.
- TA visceral preperitoneal: tejido visceral ectópico.

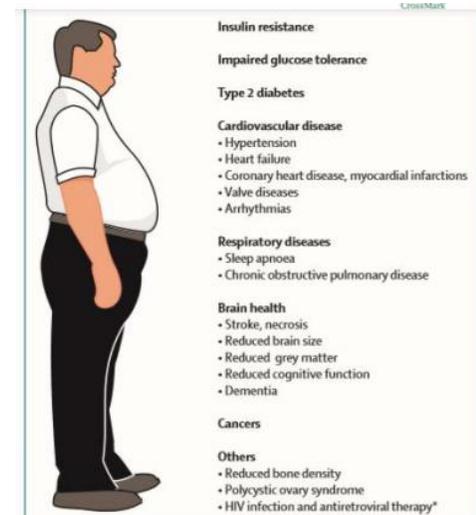


Figure 2: Health and metabolic abnormalities associated with an excess of visceral adipose tissue

# Limitaciones

- No existen medidas de normalidad ni por patologías.
- Se necesitan estudios clínicos que ayuden a establecer unos protocolos estandarizados de evaluación.
- Operador dependiente: alteración inducida por el impacto mecánico de la presión aplicada.

# Limitaciones

- Protocolos estandarizados de evaluación → puntos de corte.



European Geriatric Medicine (2021) 12:45–59  
<https://doi.org/10.1007/s41999-020-00433-9>

REVIEW



## Application of ultrasound for muscle assessment in sarcopenia: 2020 SARCUS update

Stany Perkisas<sup>1,18,19</sup>  · Sophie Bastijns<sup>1</sup> · Stéphane Baudry<sup>2,19</sup> · Jürgen Bauer<sup>3</sup> · Charlotte Beaudart<sup>4,5,19</sup> · David Beckwée<sup>6,20</sup> · Alfonso Cruz-Jentoft<sup>7</sup> · Jerzy Gasowski<sup>8</sup> · Hans Hobbelen<sup>9,10</sup> · Harriët Jager-Wittenaar<sup>11,12</sup> · Agnieszka Kasiukiewicz<sup>13</sup> · Francesco Landi<sup>14</sup> · Magdalena Malek<sup>8</sup> · Ester Marco<sup>15</sup> · Anna Maria Martone<sup>14</sup> · Ana Merello de Miguel<sup>7</sup> · Karolina Piotrowicz<sup>8</sup> · Elisabet Sanchez<sup>7</sup> · Dolores Sanchez-Rodriguez<sup>4,16</sup> · Aldo Scafoglieri<sup>17,19</sup> · Maurits Vandewoude<sup>1,19</sup> · Veronique Verhoeven<sup>18</sup> · Zyta Beata Wojszel<sup>13</sup> · Anne-Marie De Cock<sup>1,18</sup>

SARCUS – SARCopenia through UltraSound

→ Working group Group of the European Geriatric Medicine

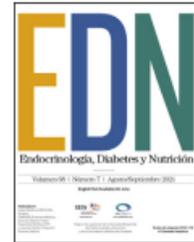
# Limitaciones

- Protocolos estandarizados de evaluación → puntos de corte.



Endocrinología, Diabetes y Nutrición

[www.elsevier.es/endo](http://www.elsevier.es/endo)



REVIEW ARTICLE

## Nutritional ultrasound<sup>®</sup>: Conceptualisation, technical considerations and standardisation

José Manuel García-Almeida<sup>a,\*</sup>, Cristina García-García<sup>b</sup>, Isabel María Vegas-Aguilar<sup>c</sup>,  
María D. Ballesteros Pomar<sup>d</sup>, Isabel María Cornejo-Pareja<sup>e</sup>,  
Beatriz Fernández Medina<sup>f</sup>, Daniel A. de Luis Román<sup>g</sup>, Diego Bellido Guerrero<sup>h</sup>,  
Irene Bretón Lesmes<sup>i</sup>, Francisco J. Tinahones Madueño<sup>j</sup>



# Conclusiones

- La ecografía es una técnica de imagen que como ventajas principales destaca su disponibilidad, bajo coste y ausencia de radiación.
- Aporta información cuantitativa y cualitativa, tanto en el paciente estable como en el paciente crítico.
- La valoración del tejido adiposo nos ayuda a identificar diferentes perfiles de riesgo metabólico y cardiovascular.
- Es necesario establecer protocolos para poder sacar el máximo partido y reproducibilidad.

GRACIAS !

[Fiorellaximena.palmas@vallhebron.cat](mailto:Fiorellaximena.palmas@vallhebron.cat)