InBody for kliniske ernæringsfysiologer

Screening med InBody gir hurtige og presise svar på:

- Skjelettmuskulatur
- Fettfri kroppsvekt
- Hvordan muskulaturen er fordelt
- Balanse i muskulatur
- Kroppsform (midje-hofte mål)
- Liv-vidde
- Hofte-liv-vidde
- Visceralt fett
- Fettprosent
- BMI
- Hvilestoffskifte
- Phase angle / fasevinkel
- Vann i og utenfor cellene
- Idealvekt

Noen referanser

Senter for sykelig overvekt i Vestfold

Haukeland Universitetssykehus - Hjerte og rehabilitering

Haukeland Universitetssykehus - Poliklinikk for overvekt

Haukeland Universitetssykehus - Forskning

Sjøkrigsskolen

Sjøforsvarets idretts- og treningssenter (SITS)

Norges Idrettshøgskole

Ullevål Universitetssykehus (Barneprosjekt)

Forsvarets Overkommando, Idrettsavdelingen,

Høgskolen i Agder

Høgskolen i Hedmark

Krigskolen Linderud

NTNU / St Olavs Hospital (fedme)

NTNU / St Olavs Hospital (forskning)

Rikshospitalet

Flymedisinsk Institutt

NTNU Forskningsprosjektet HUNT 4

NTNU

Oslo universitetssykehus

Flymedisinsk Institutt

HELSE BERGEN
Haukeland universitetssjukehus

InBody

Presis analyse av kroppens sammensetning. Les mer om testen på **www.bodyanalyse.no**
Registrer testene dine på ditt private område på **www.kroppsanalyse.no** eller app'en **kroppsanalyse**

[InBody770]

ID	Høyde	Alder	Kjønn	Dato/Tid
	188cm	53	Male	14. 10. 2017 18:11

Analyse av kroppens sammensetning

	Verdier	Kroppsvann	Fettfri kroppsvekt	Fettfri masse	Vekt
Kroppsvann (L)	62. 6 (43. 7~53. 5)	62. 6	UMIS 80. 6 (56. 2~68. 6)	85. 7 (59. 5~72. 7)	102. 2 (66. 1~89. 5)
Protein (kg)	17. 0 (11. 7~14. 3)				
Mineraler (kg)	6. 12 (4. 04~4. 94)				
Kroppsfett (kg)	16. 5 (9. 3~18. 7)				

Muskel- og fett analyse

	Under	Normal	Over
Vekt (kg)			102. 2
Muskelmasse (kg)			49. 1
Kroppsfett (kg)			16. 5

Vekt diagnose

	Under	Normal	Over
BMI (kg/m²) Body Mass Index			28. 9
PBF (%) Fettprosent			16. 2

Kroppsbalanse muskulatur

Based on ideal weight ▬▬ Based on current weight ▬▬

	Under	Normal	Over	ECW Ratio
Høyre arm (kg)			5. 16	0. 376
(%)			128. 6	
Venstre arm (kg)			5. 25	0. 378
(%)			130. 9	
Overkropp (kg)			37. 0	0. 374
(%)			115. 8	
Høyre ben (kg)			12. 61	0. 372
(%)			113. 0	
Venstre ben (kg)			12. 37	0. 375
(%)			110. 9	

ECW analyse

	Under	Normal	Over
ECW Ratio			0. 374

Utvikling av kroppens sammensetning

	14. 10. 17 18:11
Vekt (kg)	102. 2
Muskelmasse (kg)	49. 1
Fettprosent (%)	16. 2
ECW Ratio	0. 374

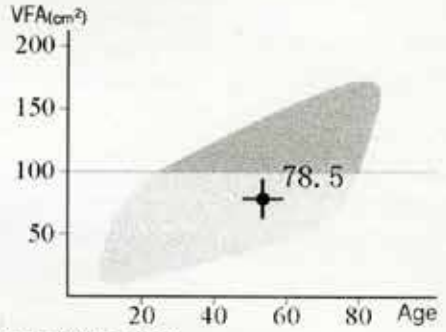
☑ Recent ☐ Total

InBody Score

98/100 Points

* Total score that reflects the evaluation of body composition. A muscular person may score over 100 points.

Visceral Fat Area



Weight Control

Target Weight	100. 8 kg
Weight Control	−1. 4 kg
Fat Control	−1. 4 kg
Muscle Control	0. 0 kg

Nutrition Evaluation

Protein	☑ Normal	☐ Deficient	
Minerals	☑ Normal	☐ Deficient	
Body Fat	☑ Normal	☐ Deficient	☐ Excessive

Segmental Fat Analysis

Right Arm	(0. 7kg)	100. 5%
Left Arm	(0. 7kg)	97. 0%
Trunk	(9. 6kg)	195. 8%
Right Leg	(2. 1kg)	105. 4%
Left Leg	(2. 1kg)	103. 1%

Research Parameters

Intracellular Water	39. 2 L	(27. 1~33. 1)
Extracellular Water	23. 4 L	(16. 6~20. 4)
Skeletal Muscle Mass	49. 1 kg	(33. 6~41. 0)
Basal Metabolic Rate	2220 kcal	
Waist-Hip Ratio	0. 89	(0. 80~0. 90)
Waist Circumference	97. 1 cm	
Arm Muscle Circumference	33. 9 cm	
Recommended calorie intake	3088 kcal	

Whole Body Phase Angle

ϕ(°) 50 kHz 6. 8°

Impedance

		RA	LA	TR	RL	LL
Z(Ω)	1 kHz	275. 1	271. 9	20. 4	243. 0	249. 8
	5 kHz	265. 9	261. 2	19. 9	234. 4	240. 4
	50 kHz	227. 4	221. 4	16. 9	197. 2	202. 8
	250 kHz	202. 1	198. 8	13. 7	177. 4	182. 8
	500 kHz	194. 8	192. 3	12. 4	173. 0	178. 0
	1000 kHz	190. 4	188. 5	11. 2	169. 3	174. 2

InBody^{720} Forklaring av resultatskjema

Analyse av kroppens sammensetning	
Intracellulær væske ICW (ℓ)	ICW er betegnelsen på intracellulært vanninnhold, altså vannet som befinner seg innenfor cellemembranen.
Extracellulær væske ECW (ℓ)	ECW er betegnelsen på extracellulært vanninnhold, altså vannet som befinner seg utenfor cellene og i blodomløpet. (ECW og ICW utgjør totalt kroppsvann)
Proteiner (kg)	Protein består av grunnstoffene karbon, hydrogen, oksygen og nitrogen. Proteiner er altså sammen med kroppsvæske hovedkomponentene som utgjør fettfri kroppsmasse uten skjelett.
Mineraler (kg)	Resultatet viser hvor mye det totale mineralinnholdet utgjør i kg. **Mineraler:** Dette resultatet viser antall kilo mineraler som finnes lagret i skjelettet. (mengde mineraler er estimert)
Kroppsfett (kg)	Kroppsfettet refererer til den totale mengde lipider (fettstoff) som kan trekkes fra fettvev og andre celler. Altså total kroppsmasse minus fett fri masse.

Muskel og fett analyse	
Vekt (kg)	Viser totalvekt av kroppen. Total kroppsmasse
Muskelmasse SMM	Viser vekten av skjelettmuskulaturen (ikke hjertemuskler og viscerale muskler).
Kroppsfett (kg)	Kroppsfettet refererer til den totale mengde lipider (fettstoff) som kan trekkes fra fettvev og andre celler. Altså total kroppsmasse minus fett fri masse.

Vekt diagnose	
BMI (kg/m^2)	Resultatet viser forholdet mellom personens vekt og høyde. BMI er tatt med fordi det er en helsevariabel som ofte blir referert til, og at man med en InBody 720 test har mulighet til å se årsakene til at BMI er høy eller lav.
Kroppsfett (%)	Målingen viser hvor mange prosent av kroppen som består av fett, altså fettprosenten. (Kroppsfett i kg i forhold til total kroppsvekt).
Midje – hofte mål (WHR)	Viser forholdet mellom hofte- og livvidde. (WHR = livvidde / hoftevidde)

Kroppsbalanse muskulatur	
Høyre arm **Venstre arm** **Overkropp u/armer** **Høyre ben** **Venstre ben**	Disse målingene forteller noe om fordelingen av den fettfrie massen (minus skjelett) på segmentene. Ut i fra disse resultatene kan man se muskulær utvikling til hvert av segmentene og forholdet mellom dem. Den øverste søylen for hvert av segmentene forteller om mengden fettfri masse i forhold til et idealmål beregnet ut ifra individets høyde. Tallet til høyre for øverste søyle viser antall kilo fettfri masse for gjeldende segment. Søyle nummer to forteller om mengden fettfri masse i forhold til individets totale kroppsvekt. Altså samme mengde fettfri masse men i forhold til reel kroppsvekt. Gjennom å studere disse resultatene over tid, kan man se endringer i kroppsproposisjoner som resultat av for eksempel trening.
Ødem	Resultatet viser forholdet mellom ECW (extracellulært vann) og TBW (totalt kroppsvann). Ved ødem er det mer vann utenfor enn inne i cellene. Standardnivå for ødem-index er mellom 0,36 og 0,40. InBody 720 viser også segmentellt ødem.
Visceral Fat Area 	Resultatet viser en grafisk fremstilling av visceralt fett i buken. Når området av visceralt fett er over 100cm^2 er det definert som *bukfedme*, noe som statistisk gir økt helserisiko. Fett blir, avhengig av lokasjon, delt inn i visceralt fett, underhudsfett og intramuskulært fett. Det er området for visceralt fett som er beregnet her. Det skyggelagte området indikerer referanseområdet og viser at verdien av visceralt fett øker proporsjonalt med alder. Det individuelle resultatet er markert med *.
Referanseområde	Helseanbefalinger fra WHO (verdens helseorganisasjon). *(ikke gjennomsnitt, Ikke anbefalinger i.f.m. prestasjon/ idrett)*. **BMI, Kroppsfett** % og **WHR** er standardiserte anbefalinger fra WHO. Referanseområdet for andre variabler er individuelle estimater med utgangspunkt i WHOs kjente anbefalinger.

Ernærings Evaluering
Vekt Sammensetning
Vekt diagnose
Kroppsbalanse muskulatur
Kroppsstyrke
Helsediagnose

Disse dataene er "oppsummering" av de ulike målingene fra testen.

Overskriftene her refererer til konkrete variabler på resultatskjema.

Vekt diagnose (kg)	
Idealvekt **Vektjustering** **Fettkontroll** **Muskelkontroll**	Vektdiagnose er tilbudt som en optimalisering av testpersonens kroppssammensetning. Målene for trening bør ikke alltid settes ut ifra vekt diagnose alene, men i samråd med fagpersonell slik at helheten blir tatt med i vurderingen.
Helsescore	Samlescore for å forstå tilstanden til testpersonens kroppssammensetning (normal, sunn kroppssammensetning er 70 – 90).

Additional Data

Obesity Degree =	Kalkulert ved bruk av BMI metoden, ikke hensyn til sammensetningen (BMI 22,0 = 100%)
BCM =	Mengde kroppsceller (Sum av celler som inneholder ICW og Protein)
BMC =	Viser mineralene i skjelettet (vist over ved siden av mineraler)
BMR =	(Basal metabolic rate). Viser en estimering av hvilestoffskiftet.
A C =	Estimering av omkrets til venstre overarm (midt mellom albue og skulder).
AMC =	A C uten fettvev (altså omkretsen av overarmen uten underhudsfett).

Registrer testene dine på ditt private område på **www.kroppsanalyse.no**. Siden utvikler grafer og prosentutregninger som gir deg full kontroll på utviklingen av din kroppsammensetning.

Inbody er nummer én i verden med ny teknologi

I 1996 ble InBody utviklet av Biospace ved hjelp av multifrekvens BIA teknologi hvor overkropp, armer og ben ble målt separert og direkte ved motstandsanalyse. Væske utenfor og innenfor cellene ble også nøyaktig målt.

Inbody bruker ikke empiriske data - og gir deg derfor de mest nøyaktige resultatene. På andre maskiner vil du se at dersom man endrer kjønn, alder eller kroppstype vil resultatene endre seg dramatisk - selvom kroppssammensetningen er den samme.
Er du mann på 40 år og tester deg som kvinne 20 på InBody så får du samme resultat

Hvis du skal jobbe med folk som ikke er Standard eller Atletisk som er det vår mening at InBody vil gi deg de mest nøyaktige resultatene.
Dette understøttes av vitenskapelige studier som er publisert her: bodyanalyse.no/Studier
De viktigste forskjellene på InBody og annen teknologi er :

- **InBody er den eneste måleinstrumentet som IKKE bruker estimering av fett og muskulatur basert på historiske data eller kjønn og alder.**
- **Man trenger ikke å være *standard* eller *atletisk* for å få like resultateter, da dette ikke registreres inn på InBody.**
- **InBody er det eneste måleinstrumentet som beregner idealvekt og samtidig tar hensyn til personens muskelmasse.**
- **InBody er det eneste måleinstrumentet som måler skjelletmuskulaturen som er den muskulaturen som endres via fysisk aktivitet.**
- InBody er det instrumentet med lengst analysetid og som måler med flest frekvenser.
- Flere konkurrerende maskiner bruker BMI som normal, dette er målemetoder som er på vei ut.

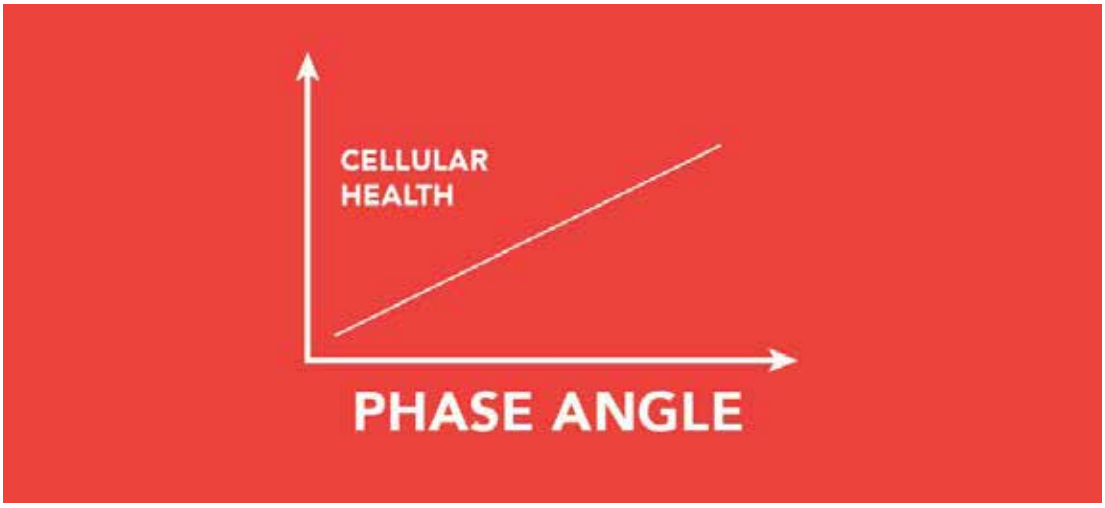
InBody viser liv-hoftevidde og ødem.

Den tidligere BIA teknologien var ikke nøyaktig nok
Empiriske beregninger bygger på gjennomsnittsverdier. Denne type beregninger tar typisk utgangspunkt i faktorer som alder, kjønn, etnisitet og kroppstype (standard eller atletisk). Hva hvis du ikke er standard eller atletisk? Og hva er definisjonen på det? Slike beregninger er lite nøyaktig og vil derfor gjøre det vanskelig å følge opp en kroppssammensetning som er i endring. Ved all testing vil det være viktig å følge testforberedelsene for nøyaktige resulater.
Om du måler blodtrykket ditt for eksempel, blir ikke kjønn eller alder lagt til grunn for resultatet du får. Det samme gjelder om man tar en CT, MRI eller andre medisinske undersøkelser. Empiriske data kan altså ikke legges til grunn for å foreta en nøyaktig måling. Forestill deg at man skanner en person som er 18 år - som en uke senere er blitt 19 år. Måleinstrumenter som bruker empiriske data vil nå anta at personen er blitt ett år eldre. Generelt vil lite ha endret seg på én uke, men maskinen som baserer beregningene på empiriske data vil nå viseendringer. Prøv gjerne dette selv om du har tilgang til en kroppsanalysemaskin som baserer resultatene på empiriske data.Eller prøv å teste deg som standard eller atletisk

InBody benytter seg ikke av empiriske data og det finnes per dags dato over 500 validerende studier på InBodys nøyaktighet.Se www.bodyanalyse.no/Studier for mer informasjon og dokumentasjon. Ta også gjerne kontakt med oss.
Inbody brukes i stor skala over hele verden og er verdensledende innen BIA-teknologien.

Your Body and You: A Guide to Phase Angle

July 05, 2017



When it comes to body composition testing and analysis, most people would think of body fat percentages right away. Yet today's BIA (bioelectrical impedance analysis) devices do so much more than just gauge the amount of body fat you carry.

Think of body fat percentages as merely icing on the cake. Body fat is what we see but body composition is so much more underneath that icing and new BIA devices can help us see some of these 'hidden' health indicators.

For body composition devices using Direct Segmental Multifrequency-BIA technology (DSM-BIA), you can also track other valuable outputs like your skeletal muscle mass, body water distribution, segmental readings, and phase angle values.

Although your body fat percentage can be a strong indicator of your overall health and current state of your body composition, the aforementioned outputs are equally useful metrics that can help predict or detect health issues.

In this article, let's go beyond the usual discussions on body fat and muscle mass when it comes to body composition. Embrace your inner Sherlock and read on to uncover one of the most valuable outputs provided by a huge chunk of today's BIA devices — your Phase Angle (PhA).

What's a Phase Angle Anyway?

In his book *The Water Secret: The Cellular Breakthrough to Look and Feel 10 Years Younger*, celebrity dermatologist and skin care expert Dr. Howard Murad writes:

> *PhAs have given us a remarkable window into how the body responds to changes in health — for better or worse. This explains why people with illnesses such as HIV or cancer, or those who are nutritionally deficient, routinely exhibit low PhAs. As expected, PhAs also decrease with age as your body loses its capacity to repair and return over new cells as quickly as it did in its youth. The true age of a human being can be determined by the changes in the Phase Angle.*

Furthermore, he elaborated:

> *The Phase Angle goes up when you're healthy and down when you're ill. It also goes down as you age. When you increase your Phase Angle, you slow down aging.*

Whether you're one of those who wholeheartedly believes Dr. Murad's views on PhA and its relationship to your

health or you're finding yourself siding with the skeptical camp, stick around for a bit as we learn more about established facts and research findings about PhA.

Demystifying Phase Angle

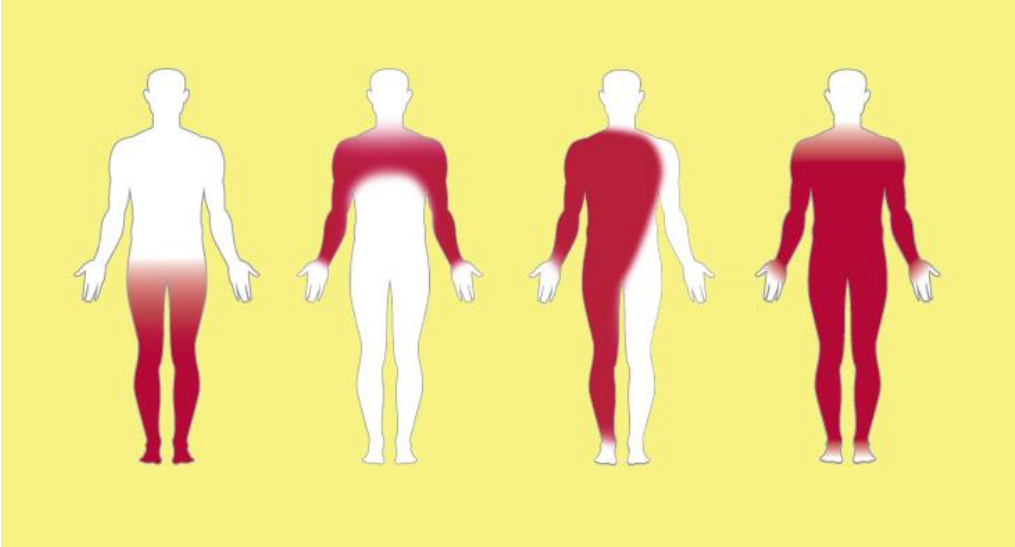
Before you leave the page and think that we're going to go full-bore sciencey on you, hang on. We're not going to talk about biology and physics until the end of the article but you need to have a grasp of the basics to understand why knowing your PhA is incredibly important.

Your PhA is a direct measurement of your cell membrane integrity, and the distribution of water within and outside the cell. In his book *Supercharge Your Cell Vitality*, author Dr. Greg Barsten refers to PhA as merely a fancy name for **cell health**.

Cell membranes hold in the important parts of the cell and also regulate what comes in and out. Think of it as fortress.

In healthy humans, the cell membrane consists of a layer of non-conductive (insulator) lipid material sandwiched between two layers of conductive fluids (body water). When there are two conducting materials surrounding an insulator, we often refer to this insulator as a capacitor. That said, your cell membrane is like a fortress with capacitor-like capabilities that not only try to prevent currents from entering the cells but also other unwanted materials like toxins and waste. What this means is that healthier cells (or stronger capacitors) are better at preventing these unwanted substances from entering cells.

How is Phase Angle Measured?



In BIA, PhA is the relationship between resistance and reactance.

To understand these variables, you have to understand what lean body mass and body cell mass means.

Your **Lean Body Mass** (LBM) is the total weight of your organs, skin, bones, body water, and muscles. It describes the entire weight of your body minus your body fat. This is why it's also often referred to as fat-free mass.

On Resistance, Reactance, and Impedance

Resistance happens when a conductor transfers the energy of (or moves) an electrical current. The greater the conductor, the lower the resistance. In the human body, low resistance is associated with large amounts of LBM. High resistance is associated with smaller or low amounts of LBM.

Body fluids consisting of water and charged ions readily conducts electrical currents. Both extracellular water or ECW (water and ionized sodium Na+) and intracellular water or ICW (water and ionized potassium K+) provide a conductive pathway. When a person has a lot of lean body mass, they have a lot of body water, meaning greater conductivity of the current and less overall resistance.

It's also worth noting that resistance in the body is proportional to one's LBM because water is contained solely within your LBM. The unit of measurement for resistance is ohms.

Reactance, on the other hand, gauges your cells' ability to store energy. Your body has high reactance if your

cells can store energy easily and it has low reactance if it stores energy poorly. Cells that are “healthy” or those with intact cellular membranes hold the electrical charge "longer."

For this reason, your body reactance is proportional to both the amount and strength of the cells in your body. Like resistance, the unit of measurement for reactance is ohms.

Impedance is the sum of resistance and reactance, but when evaluated trigonometrically, the relationship between resistance and reactance creates a ratio. This ratio is your PhA and is expressed in degrees.

You can measure your PhA and cell health using a bioimpedance device that sends electrical currents is used to assess cell health. Impedance is measured by introducing a small alternating current into the body and measuring the the effects on the current caused by the body. In humans, 50 KHz is considered ideal to maximize reactance and determine the point where cells are strongest at resisting the current (thus creating the highest PhA).

As the current travels in your body, your body water will naturally resist the flow of the current as it travels and this is referred to as resistance. To keep it simple, when the current encounters a cell, the cell wall will cause a “delay” as the voltage builds up enough energy to pass through the cell wall while the current continues instantaneously. The brief time delay caused by the cells is compared to the amount of water, providing us with a phase angle, in degrees. Impedance is a combination of these two values.

Why You Should Care About Your Phase Angle

What does PhA have to do with your overall health?

By tracking your PhA, you’ll be able to gain a more precise picture of your health because it examines cell health and the amount of water inside them.

Based on established research findings, higher PhA values suggest greater cellular integrity and reflects better overall cell health. A low phase angle, on the other hand, is highly predictive of decreased muscle strength, impaired quality of life, and increased mortality in old adults with cancer. Low phase angles tend to be consistent in individuals with malnutrition, HIV/AIDS infection, cancer (discussed in detail below), chronic alcoholism, and old age.

Thus, keeping your phase angle high through healthy lifestyle habits is encouraged.

How do you know if you’re PhA is within normal values or not?

This is where things get interesting.

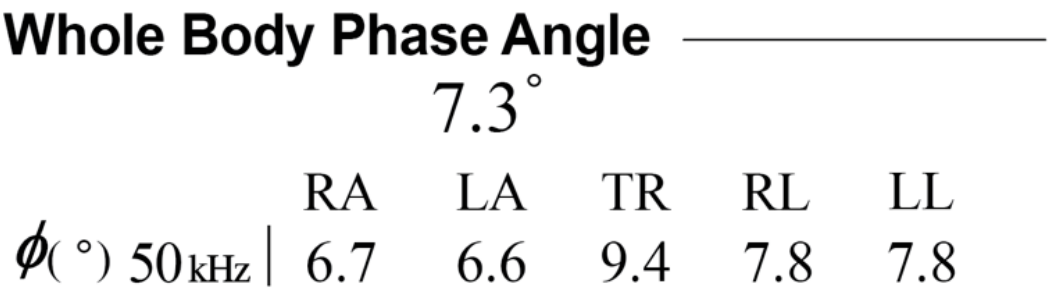
While it has been shown that certain factors can influence one’s PhA (age, gender, and BMI), it has been shown that there are considerable differences between phase angle reference values across different populations.

These differences are not only explained by age or BMI and may be due to differences between impedance analyzers.

In short, PhA values tend to differ based on the BIA device you're using. In clinical practice, multi-frequency- and segmental-BIA *may have* advantages over single-frequency BIA in these conditions, but further studies and validation are still required.

Below is an example of PhA reading using InBody's 770 model.

Phase Angle Reading Example:



Finally, it's important to note that phase angle is dependent on every person's individual makeup. To gauge progress, comparing your current phase angle readings to your previous readings is more important than comparing your PhA values with someone else's.

Your Body Composition and Phase Angle: What's the Connection?

Can improving your body composition help increase your phase angle values? It sure does.

A 2016 study revealed that age plus a combination of FFM (fat-free mass) and height were the most important variables that influence PhA variability among healthy subjects. The same research concluded that the ECW:ICW ratio may justify the variations shown in PhA when it comes to several clinical situations and severe obesity. When someone has inflammation or edema (causing a higher ECW/TBW), the health of their cells (and their phase angle) will be negatively affected.

Based on the study's results, you are likely to increase your chances of improving your cellular health and PhA values if you take steps towards improving your body composition, whether it's through nutrition, exercise, or a combination of both.

Other lifestyle factors that are most likely to impact phase angle variability include but are not limited to:

- Toxicity exposure
- Consumption of highly processed meals
- Lack of quality sleep
- Stress (physical, mental, and emotional)
- Lack of consistent physical activity
- Excess intake of coffee, alcohol, and refined sugar

The same research concluded that the ECW:ICW ratio may justify the variations shown in PhA when it comes to several clinical situations and severe obesity.

In a healthy body, an ICW:ECW ratio of 3:2 is considered ideal. However, certain health conditions like renal disease, chronic inflammation, and even increased fat mass in obesity (due to disruption of one of your body's hormone systems (the renin-angiotensin-aldosterone system) can potentially cause your ECW to go up.

For instance, patients with symptoms associated with heart failure have a limited ability for the heart to circulate blood, causing edema. When this happens, PhA values will likely go down because the pressure from excess ECW causes cells normal functions to become compromised. In fact, phase angle seems to be an independent prognostic marker in patients with ADHF (acute decompensated heart failure) because of fluid retention. For the cells to function properly, it's important to maintain or restore ideal (or near ideal) ECW (or extracellular) balance.

The link between your phase angle values and body composition can be summarized through the following:

Increased phase angle may be a result of:

- Gains in muscle mass
- Loss of inflammation and reduction of body fat

Decreased phase angle may be a result of:

- Loss of muscle tissue
- Increased inflammation

But wait, there's one caveat: an increase in PhA is not always a good thing, nor should a decrease in your PhA values always be frowned upon.

Phase Angle: Implications for Clinical Practice

In regards to PhA's use in clinical settings, research literature and data reveal the following:

A 2012 study found a significant association between low PhA and increased nutritional risk, increased hospital LOS (length of stay) and non-survival. The researchers concluded that gauging PhA values can help quickly identify patients who are at nutritional risk at hospital admission. This will help save time on the hospital staff's end (and possibly save the patient's life) because they can forego in-depth nutritional assessments by doing a quick BIA test instead.

Another set of studies came up with identical conclusions. This time around, the implications of PhA to a patient's nutritional status are more specific. It turns out that bioimpedance-derived PhA can be a potential nutritional indicator for patients with advanced colorectal cancer and breast cancer.

Finally, a research paper presented at the 2011 AAAI (Association for the Advancement of Artificial Intelligence) 2011 Spring Symposium suggested that phase angle is an **independent indicator of prognosis** in cancer (of most types) because it illustrates **cell membrane integrity and function that may not be possible with other approaches that gauge prognosis**. In fact, the paper suggested phase angle-based biometric scoring systems for determining prognosis among cancer patients. This is good news because BIA is quick and noninvasive in comparison to tools and tests used in cancer prognosis.

The Takeaway

Your PhA values can clue you in with what's going in on your body. It can help identify health risks and address existing health issues, and help track progress of lifestyle changes (diet and exercise). For most people, it has helped them make data-driven health and wellness decisions. Medical practices also use it to personalize a patient's health care plan.

However, keep in mind that your PhA values do not help paint a full picture of the current state of your health.

The rest of the body composition outputs are equally valuable so finding a BIA device that can provide more detailed outputs is crucial. For instance, changes in your body fat percentages can be tricky to explain if the only outputs you have are merely fat and fat-free mass values. For more accurate results, choose your BIA device wisely.

***

Kyjean Tomboc *is a nurse turned freelance healthcare copywriter and UX researcher. After experimenting with going paleo and vegetarian, she realized that it all boils down to eating real food.*

NOTAT: Måling av visceralt fett med InBody 720

Intro

Visceralt fett er navnet på fettvevet som omgir de indre organer i bukhulen. Visceralt fett blir også kalt bukfett eller abdominalt fett. Formålet med visceralt fett er beskyttelse og isolasjon av indre organer samt energilager. Menn har gjennomsnittlig mer visceralt fett enn kvinner (Heymsfield et al. 2005). Normalt sett øker mengden visceralt fett med alder (Heymsfield et al. 2005). Overvektige har normalt mer visceralt fett enn normalvektige, men det er bare en moderat korrelasjon mellom vekt og mengde visceralt fett (Heymsfield et al. 2005). Dermed kan en relativt slank person ha en relativt stor mengde visceralt fett, mens en overvektig person kan ha en mindre mengde av det samme fettet.

Det viser seg å være sterk assosiasjon mellom mengden visceralt fett og en rekke livvstilssykdommer (Ryo et al. 2005). Forskning viser videre at visceralt fett korrelerer sterkere med metabolsk syndrom enn både BMI og underhudsfett (Ryo et al. 2005). Det ser også ut til at mengden visceralt fett i større grad kan forklare insulinresistens enn overvekt eller høy fettprosent generelt (Nesto, 2005). I forhold til dokumentasjon på, og overvåking av en persons helsetilstand vil det dermed være svært interessant med gode metoder for måling av visceralt fett.

Computed tomography (CT)

Computed thomography (CT) regnes som en referansemetode for å måle et individs mengde visceralt fett (Yoshizumi et al. 1999). Det er utviklet en standardisert metode der man analyserer et tverrsnitt av trunkus på høyde med L4 og L5 (fig 1.), resultatet oppgis dermed i cm^2. Studier viser at arealet av visceralt fett ved en slik tverrsnittsmåling korrelerer svært godt med total mengde visceralt fett (Yoshizumi et al. 1999). Det er imidlertid begrensninger med denne metoden ved at den er svært kostbar, ressurskrevende å gjennomføre og utsetter pasienten for radioaktiv stråling.

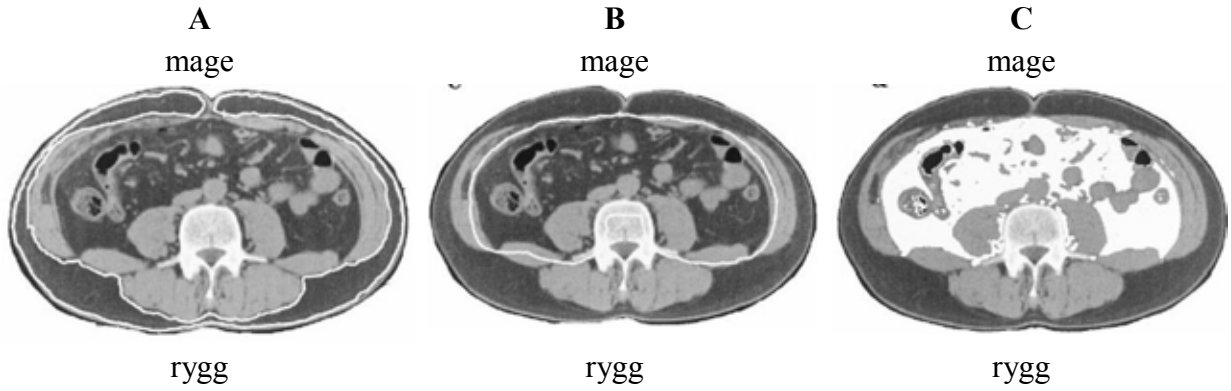


Fig 1. *Viser standardisert metode for å måle visceralt fett med CT scan. Alle tre bildene viser tverrsnitt av truncus på høyde med L4-5.* ***A*** *viser måling av underhudsfettet (omsluttet av hvit strek).* ***B*** *viser lokasjon av visceralt fett (omkranset av hvit strek, innenfor bukmuskulaturen).* ***C*** *viser måling av visceralt fett (hvitt område) når organer blir trukket fra. Enheten for resultatet er* cm^2*. (Yoshizumi et al. 1999).*

Waist – hip ratio (WHR)

Waist – hip ratio (WHR) forteller oss om forholdet mellom livvidde og hoftevidde. Formelen for WHR er enkel; livvidde delt på hoftevidde. WHR er et mye brukt helsemål siden den forteller oss noe om forekomst av sentral fedme som er assosiert med visceral fedme. Imidlertid skiller ikke metoden mellom underhudsfett og visceralt fett. Anbefalinger for WHR er forskjellig for menn og kvinner.

Bioelektrisk impedans analyse (BIA) med InBody 720

Med bioelektrisk impedans analyse (BIA) kan man ikke måle visceralt fett direkte, men ved hjelp av regresjonsmetoder, utviklet med resultater fra CT scan, kan man estimere det nøyaktig. Måling av visceralt fett med BIA bygger på prinsippet om at impedansen til en sylinder (her; trunkus) er proporsjonal med sylinderens lengde og inverst proporsjonal med sylinderens areal (tverrsnitt). Dermed kan man ved å kjenne trunkus sin lengde og impedans beregne arealet til tverrsnittet. Dette tverrsnittet sammen med regresjonsanalyser fra større studier med CT scan danner grunnlaget for estimeringen av visceralt fett. Flere studier støtter bruken av BIA metoden som et hensiktsmessig alternativ til måling av visceralt fett (Ryo et al, 1999, Nagai et al, 2008 og Demura og Sato, 2007).

En laboratoriumundersøkelse gjennomført av Biospace viste god korrelasjon mellom VFA målt med InBody 720 og CT scan (r = 0,922) (http://www.bodyanalyse.no/studier/VFA_CT.pdf). Den samme laboratorierapporten viste en SEE på 17,3 cm^3 når InBody 720 sammenliknes med referansemetoden. I en publisert studie fra 2007 konkluderer forfatterne med at VFA målt med InBody 720 korrelerer svært godt med visceral fett tykkelse målt med ultralyd, som igjen korrelerer godt med VFA målt med CT scan (Szebeni og Halmy, 2007). Det finnes altså dokumentasjon på at InBody 720 estimerer VFA på en tilfredsstillende måte. Metodene for å måle VFA er stadig under utvikling, og produsentene av InBody 720 følger denne utviklingen nøye. Derfor vil nye oppgraderinger av programvare til en hver tid inneholder de mest valide formlene.

Referanseområdet med en skillelinje på 100cm^2

Bakgrunnen for et referanseområde med en skillelinje på 100cm^2 er kartlegging av symptomer på metabolsk syndrom. Dette ble utviklet i en stor studie som undersøkte forholdet mellom visceralt fett og andre risikofaktorer for diabetes og hjerte- karsykdom (Nagai et al. 2008). Skillelinjen på 100cm^2 symboliserer altså en statistisk forskjell i sjansene for forekomst av annen helserisiko assosiert med hjerte- karsykom. Med et visceralt fett areal på over 100cm^2 har man altså, statistisk sett, økt risiko for andre symptomer som kan føre til hjerte- karsykdom.

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Nagi M, Komiya H, Mori Y, Ohta T, Kasahara Y & Ikeda Y. (2008). Development of a new method for estimating visceral fat area with multi-frequens bioelectrical impedance. *Tohoku J Exp Med.* 214: 105-12

Nesto RW. (2005). Obesity, a mayor component of the metabolic syndrome. *Texas heart institute journal. 32(3):* 387- 9

Ryo M. Maeda K. Onda T. Katashima M. Okumiya A. Nishida M & Yamaguchi T et al. (2005). A new simple method for the measurement of virsceral fat accumulation by bioelectrical impedance. *Diabetes care*. 28(2): 451-3

Szebeni A & Halmy L. (2007). Measurement of visceral fat thickness by ultrasound and comparison with visceral fat area determinations. *Gastroenterol*. 45.

Yoshizumi T. Nakamura T. Yamane M. Waliul Islam AH. Menju M. Yamasaki K & Arai T et al. (1999). Abdominal Fat: standardized technique for measurement at CT. *Radiology* 211: 283-6

Elektroniske kilder:

Labb-rapport Biospace: *http://www.bodyanalyse.no/studier/VFA_CT.pdf (18.10.2010)*

J Diabetes Complications. 2017 Mar;31(3):537-543. doi: 10.1016/j.jdiacomp.2016.11.002. Epub 2016 Nov 6.

Risk factors for autonomic and somatic nerve dysfunction in different stages of glucose tolerance.

Dimova R[1], Tankova T[2], Guergueltcheva V[3], Tournev I[4], Chakarova N[2], Grozeva G[2], Dakovska L[2].

Author information

Abstract

AIM: The present study evaluates autonomic and somatic nerve function in different stages of glucose tolerance and its correlation with different cardio-metabolic parameters.

MATERIAL AND METHODS: Four hundred seventy-eight subjects, mean age 49.3±13.7years and mean BMI 31.0±6.2kg/m2, divided according to glucose tolerance: 130 with normal glucose tolerance (NGT), 227 with prediabetes (125 with impaired fasting glucose (IFG) and 102 with isolated impaired glucose tolerance (iIGT)), and 121 with newly-diagnosed T2D (NDT2D), were enrolled. Glucose tolerance was studied during OGTT. Antropometric indices, blood pressure, HbA1c, serum lipids, hsCRP and albumin-to-creatinine ratio were assessed. Body composition was estimated by a bioimpedance method (InBody 720, BioSpace). Tissue AGEs accumulation was assessed by skin autofluorescence (AGE-Reader-DiagnOpticsTM). Electroneurography was performed by electromyograph Dantec Keypoint. Cardiovascular autonomic neuropathy (CAN) was assessed by ANX-3.0 method applying standard clinical tests.

RESULTS: CAN was found in 12.3% of NGT, 19.8% of prediabetes (13.2% of IFG and 20.6% of iIGT), and 32.2% of NDT2D. The prevalence of diabetic sensory polyneuropathy (DSPN) was 5.7% in prediabetes and 28.6% in NDT2D. The panel of age, QTc interval, waist circumference, diastolic blood pressure, and 120-min plasma glucose was related to sympathetic activity (F [5451]=78.50, p<0.001). The panel of age, waist circumference, and QTc interval was related to parasympathetic power (F [3453]=132.26, p<0.001). HbA1c and age were related to sural SNAP (F [2454]=15.12, p<0.001). HbA1c and AGEs were related to sural SNCV (F [2454]=12.18, p<0.001).

CONCLUSIONS: Our results demonstrate a high prevalence of autonomic and sensory nerve dysfunction in early stages of glucose intolerance. Age, postprandial glycemia, central obesity, diastolic blood pressure and QTc interval outline as predictive markers of CAN; hyperglycemia, glycation and age of DSPN.

KEYWORDS: Cardiovascular autonomic; Diabetic sensory polyneuropathy; Glucose tolerance; Sensory neuropathy

BMC Cardiovasc Disord. 2011 Feb 1;11:7. doi: 10.1186/1471-2261-11-7.

The relationship between various measures of obesity and arterial stiffness in morbidly obese patients.

Nordstrand N[1], Gjevestad E, Dinh KN, Hofsø D, Røislien J, Saltvedt E, Os I, Hjelmesæth J.

Author information

Abstract

BACKGROUND: Obesity is associated with increased risk of cardiovascular disease. Arterial stiffness assessed by carotid femoral pulse wave velocity (PWV) is an independent predictor of cardiovascular morbidity and mortality. We aimed to investigate how various measures of body composition affect arterial stiffness.

METHODS: This is an analysis of cross-sectional baseline data from a controlled clinical trial addressing changes in arterial stiffness after either surgery or lifestyle intervention in a population of morbidly obese patients. High-fidelity applanation tonometry (Millar, Sphygmocor) was used to measure pulse wave velocity (PWV). Carotid femoral PWV is a direct measure of arterial stiffness and is considered to be the gold standard method. The Inbody 720 Body Composition Analyzer was used for bioelectrical impedance analysis (BIA). Spearman's correlation, independent samples t-test, chi-square tests, Fisher's exact test and multiple linear regression analyses were used as statistical methods.

RESULTS: A total of 133 patients (79 women), with a mean (SD) age of 43 (11) years were included in the study. Men had a significantly higher prevalence of obesity related comorbidities and significantly higher PWV, 9.1 (2.0) m/s vs. 8.1 (1.8) m/s, p = 0.003, than women. In the female group, PWV was positively correlated with WC, WHtR, BMI and visceral fat area. In the male group, PWV was negatively correlated with BMI. Multiple linear regression analysis showed that increasing BMI, WC, WHtR, visceral fat area and fat mass were independently associated with higher PWV in women, but not in men, after adjustment for age, hypertension and type 2 diabetes.

CONCLUSION: Most measures of general and abdominal obesity were predictors of arterial stiffness in female morbidly obese patients.

TRIAL REGISTRATION: ClinicalTrials.gov Identifier NCT00626964.

PMID: 21284837 PMCID: PMC3042421 DOI: 10.1186/1471-2261-11-7

[Indexed for MEDLINE] Free PMC Article

Obes Surg. 2014 Sep;24(9):1476-80. doi: 10.1007/s11695-014-1190-5.

Validation study of multi-frequency bioelectrical impedance with dual-energy X-ray absorptiometry among obese patients.

Faria SL[1], Faria OP, Cardeal MD, Ito MK.

Author information

Abstract

BACKGROUND: Body mass index (BMI) is the most common parameter for classifying nutritional status. However, body composition (BC) may vary considerably among individuals with identical BMIs; consequently, we need to assess BC efficiently. Bariatric surgery is the most effective method for treating obesity. To improve quality assessment of postoperative weight loss, it is essential to assess BC. Multi-frequency bioelectrical impedance analysis (BIA) is a practical assessment instrument, though limited when applied among the obese population. Despite dual-energy X-ray absorptiometry (DXA) being the current reference standard, it has physical limitations which restrict its practical application. This study, therefore, sought to correlate the results of BC assessments of same patient population using BIA and DXA.

METHODS: This was a cross-sectional validation study with patients invited to undergo a multi-frequency BIA (Inbody 720®) and afterwards a DXA examination Statistical analyses were done using the intraclass correlation coefficient (ICC), paired t-test and the Bland-Altman plot analysis.

RESULTS: A total of 108 patients were randomly selected, with 73 meeting the criteria for study inclusion. Most were female (89%) and had an average BMI of 40.17 ± 4.08 kg/m(2). An almost perfect correlation of fat (kg) and fat-free mass (kg) was found in results from the BIA and DXA examination (ICC = 0.832 and ICC = 0.899, respectively). A substantial correlation was also found between the percentage of body fat (%BF) and the percentage of fat-free mass (%FFM). The comparison made between the BIA and DXA using the t-test showed significant differences between all parameters. The Bland-Altman plot showed that the BIA method tends to underestimate the FM and overestimate the LM measurements when compared with DXA.

CONCLUSION: BIA proved to be a safe alternative for assessing BC in clinically severely obese patients and thus provides a more accessible evaluation tool for this population. But, consideration should be given to the formula added to the BIA measurement, adjusting the values to differences observed in order to reduce errors when compared with the DXA measurements.

PMID: 24464546 DOI: 10.1007/s11695-014-1190-5

[Indexed for MEDLINE]

Ann Surg Oncol. 2014 Oct;21(11):3675-9. doi: 10.1245/s10434-014-3737-z. Epub 2014 May 5.

Changes in body composition secondary to neoadjuvant chemotherapy for advanced esophageal cancer are related to the occurrence of postoperative complications after esophagectomy.

Ida S[1], Watanabe M, Karashima R, Imamura Y, Ishimoto T, Baba Y, Iwagami S, Sakamoto Y, Miyamoto Y, Yoshida N, Baba H.

Author information

Abstract

BACKGROUND: Although a survival benefit of neoadjuvant treatment for patients with esophageal cancer has been highlighted, the influence of neoadjuvant treatment on the nutritional status of patients with esophageal cancer is not well understood.

METHODS: Changes in body composition parameters were assessed in 30 patients who underwent neoadjuvant chemotherapy (NAC) comprising docetaxel, cisplatin, and 5-fluorouracil followed by esophagectomy from August 2009 to April 2013. Body composition was evaluated before and after NAC using multifrequency bioelectrical impedance analysis (InBody 720; Biospace, Tokyo, Japan). Postoperative complications were graded according to the Clavien-Dindo classification.

RESULTS: Twenty-three postoperative events occurred in 16 patients. A decrease in body protein was observed in 13 patients (43.3 %), while skeletal muscle (SM), body cell mass (BCM), and fat-free mass (FFM) declined in 11 patients (36.7 %) during NAC. Changes in these four parameters during chemotherapy significantly differed between patients with postoperative complications and those without: protein, -1.6 ± 0.9 versus +4.4 ± 2.1 kg (P = 0.01); SM, -1.3 ± 1.1 versus +4.7 ± 2.4 kg (P = 0.02); BCM, -2.4 ± 1.6 versus +3.8 ± 2.2 kg (P = 0.03); and FFM, -1.4 ± 1.4 versus +4.3 ± 2.3 kg (P = 0.04).

CONCLUSIONS: Changes in body composition parameters are possible predictive markers of postoperative complications after esophagectomy after NAC. Further analysis is needed to clarify whether nutritional intervention improves such parameters and thus contributes to reduced postoperative morbidity.

PMID: 24793436 DOI: 10.1245/s10434-014-3737-z

[Indexed for MEDLINE]

J Gastrointest Surg. 2016 Mar;20(3):611-8. doi: 10.1007/s11605-015-3055-1. Epub 2015 Dec 21.

Postoperative Changes in Body Composition After Pancreaticoduodenectomy Using Multifrequency Bioelectrical Impedance Analysis.

Mikamori M[1,2], Miyamoto A[1], Asaoka T[1,2], Maeda S[1], Hama N[1], Yamamoto K[1], Hirao M[1], Ikeda M[1], Sekimoto M[1], Doki Y[2], Mori M[2], Nakamori S[3].

Author information

Abstract

BACKGROUND: Nutritional status is one of the most important clinical determinants of outcome after surgery. The aim of this study was to compare changes in the body composition of patients undergoing pancreaticoduodenectomy (PD), distal gastrectomy (DG), or total gastrectomy (TG).

METHODS: The parameters of body composition were measured using multifrequency bioelectrical impedance analysis with an inBody 720 (Biospace Inc. Tokyo. Japan) in 60 patients who had undergone PD (n = 18), DG (n = 30), or TG (n = 12). None of the patients had recurrence or were treated with chemotherapy. Changes between the preoperative data and results and those obtained 12 months after surgery were evaluated.

RESULTS: Twelve months after surgery, the body weight change in the PD group was significantly lower than in the TG and DG groups (-1.2 ± 3.8 vs -7.4 ± 4.4 and -4.0 ± 3.2 kg, respectively; $p < 0.01$ vs TG, $p < 0.05$ vs DG). The body weight change correlated with the fat mass change in all groups.

CONCLUSIONS: The type and extent of surgery has a different effect on long-term body weight and body composition. Bioelectric impedance analysis can be used to assess body composition and may be useful for nutritional assessment in patients who have undergone these surgeries.

KEYWORDS: Body composition; Body weight; Gastrectomy; Multifrequency bioelectrical impedance analysis; Pancreaticoduodenectomy

PMID: 26691149 DOI: 10.1007/s11605-015-3055-1

[Indexed for MEDLINE]

Br J Nutr. 2012 Apr;107(8):1217-20. doi: 10.1017/S0007114511004028. Epub 2011 Sep 28.

Determinants of bioelectrical phase angle in disease.

Stobäus N[1], Pirlich M, Valentini L, Schulzke JD, Norman K.

Author information

Abstract

Phase angle (PhA), a parameter of bioelectrical impedance analysis, is a well-known predictor of morbidity and mortality in various diseases. The causes of decreased PhA are, however, not yet completely understood. We therefore investigated determinants of PhA in 777 hospitalised patients in a retrospective analysis. PhA was assessed by bioelectrical impedance analysis at 50 KHz. Subjective global assessment (SGA) was used to evaluate nutritional status. Age, sex, BMI as well as nutritional status (SGA), benign or malignant disease and C-reactive protein (CRP) were investigated as potential determinants of PhA and standardised PhA (SPhA) = (observed PhA - mean PhA of reference values)/standard deviation of reference values in a general linear model regression analysis. Next to age (estimated effect size, 46·6%; P<0·0001), malnutrition (39·1%; P<0·0001) emerged as a major PhA determinant in our study population. Moreover, sex (6·4%; P<0·0001), CRP (4·4%; P<0·0001) and BMI (3·5%; P < 0·0001) exhibited a significant influence on PhA, whereas malignant disease showed no significant effect in this model. The only significant determinants of SPhA were malnutrition (85·4%; P<0·0001) and inflammation (9·6 %; P<0·0001). In conclusion, next to the established predictors, malnutrition and inflammation have a strong impact on PhA in sick individuals, which partly explains its prognostic power. When investigating the SPhA, only malnutrition and inflammation were found to be significant predictors, as a result of which the SPhA is considered a more suitable indicator of nutritional and health status.

PMID: 22309898 DOI: 10.1017/S0007114511004028

[Indexed for MEDLINE]

Clin Nutr. 2012 Dec;31(6):854-61. doi: 10.1016/j.clnu.2012.05.008. Epub 2012 Jun 12.

Bioelectrical phase angle and impedance vector analysis--clinical relevance and applicability of impedance parameters.

Norman K[1], Stobäus N, Pirlich M, Bosy-Westphal A.

Author information

Abstract

BACKGROUND & AIMS: The use of phase angle (PhA) and raw parameters of bioelectrical impedance analysis (BIA) has gained attention as alternative to conventional error-prone calculation of body composition in disease. This review investigates the clinical relevance and applicability of PhA and Bioelectrical Impedance Vector Analysis (BIVA) which uses the plot of resistance and reactance normalized per height.

METHODS: A comprehensive literature search was conducted using Medline identifying studies relevant to this review until March 2011. We included studies on the use of PhA or BIVA derived from tetrapolar BIA in out- and in-patient settings or institutionalized elderly.

RESULTS: Numerous studies have proven the prognostic impact of PhA regarding mortality or postoperative complications in different clinical settings. BIVA has been shown to provide information about hydration and body cell mass and therefore allows assessment of patients in whom calculation of body composition fails due to altered hydration. Reference values exist for PhA and BIVA facilitating interpretation of data.

CONCLUSION: PhA, a superior prognostic marker, should be considered as a screening tool for the identification of risk patients with impaired nutritional and functional status, BIVA is recommended for further nutritional assessment and monitoring, in particular when calculation of body composition is not feasible.

PMID: 22698802 DOI: 10.1016/j.clnu.2012.05.008

[Indexed for MEDLINE]

Validity study

Validity study of BIA device for Fat free mass, fat mass, percent body fat

Validation Study of Multi-Frequency Bioelectrical Impedance with Dual-Energy X-ray Absorptiometry Among Obese Patients Faria SL et al Obes Surg 2014

Accuracy of segmental multi-frequency bioelectrical impedance analysis for assessign whole-body and appendicular fat mass and lean soft tissue mass in frail women aged 75 years and older M Kim and H Kim Eur J Clin Nutr 2013

Body composition measurements determined by air displacement plethysmography and eight-polar bioelectrical impedance analysis are equivalent in African American College students. WY So et al. HealthMed 2012

Assessment of body composition in peritoneal dialysis (PD) patients using bioelectrical impedance and dual-energy x-ray absorptiometry. Fürstenberg A, Davenport A. Am J Nephrol. 2011

Comparison of multifrequency bioelectrical impedance analysis and dual energy x-ray absorptiometry assessments in outpatient hemodialysis patients. Fürstenberg A, Davenport A. Am J Kidney Dis 2011

Accuracy of direct segmental multi-frequency bioimpedance analysis in the assessment of total body and segmental body composition in middle-aged adult population. Ling CH et al. Clin Nutr. 2011

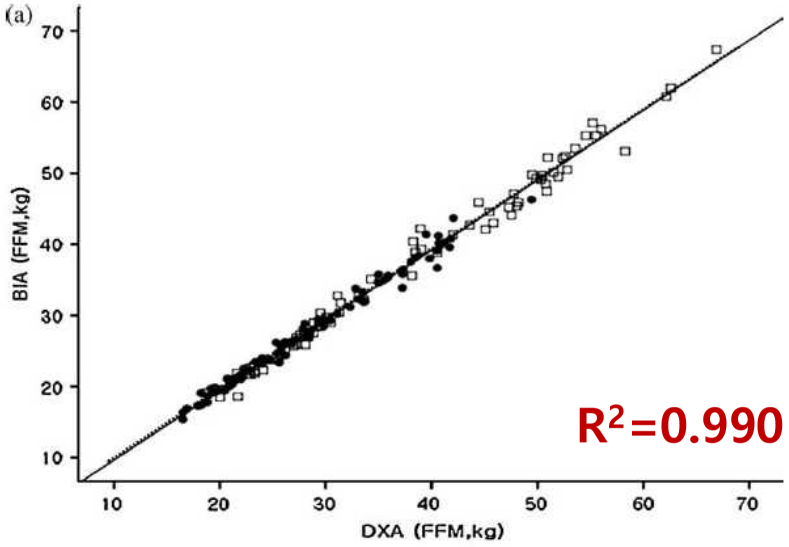
Cross-calibration of multi-frequency bioelectrical impedance analysis with eight-point tactile electrodes and dual-energy X-ray absorptiometry for assessment of body composition in healthy children aged 6 – 18 years. Jung S. Lim et al Pediatrics International 2009

Validity study

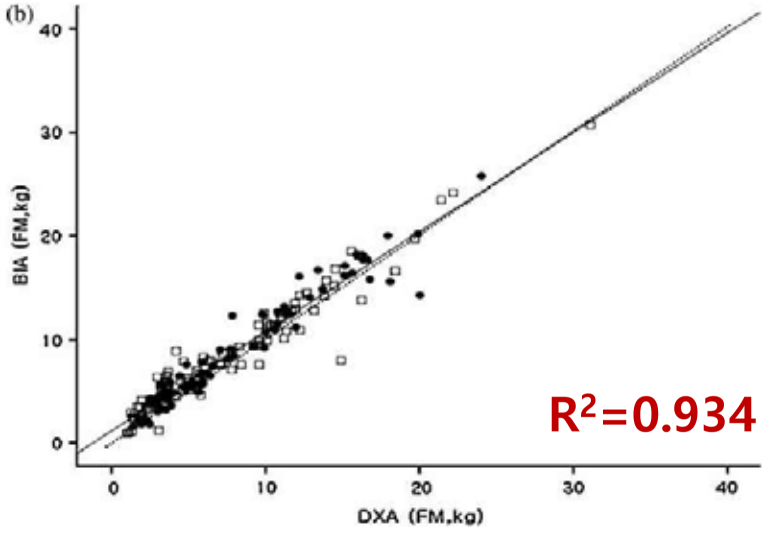
Pediatrics International (2009) **51**, 263–268 doi: 10.1111/j.1442-200X.2008.02698.x

Original Article

Cross-calibration of multi-frequency bioelectrical impedance analysis with eight-point tactile electrodes and dual-energy X-ray absorptiometry for assessment of body composition in healthy children aged 6–18 years



InBody vs. DEXA (Fat free mass)



InBody vs. DEXA (Fat Mass)

Pediatr Int. 2009 Apr;51(2):263-8

Validity study

InBody 720 as a New Method of Evaluating Visceral Obesity

Hisataka Ogawa[1], Kazumasa Fujitani[1], Toshimasa Tsujinaka[1], Kenji Imanishi[2], Hatsumi Shirakata[2], Aiko Kantani[2], Motohiro Hirao[1], Yukinori Kurokawa[1], Shigetoshi Utsumi[2]

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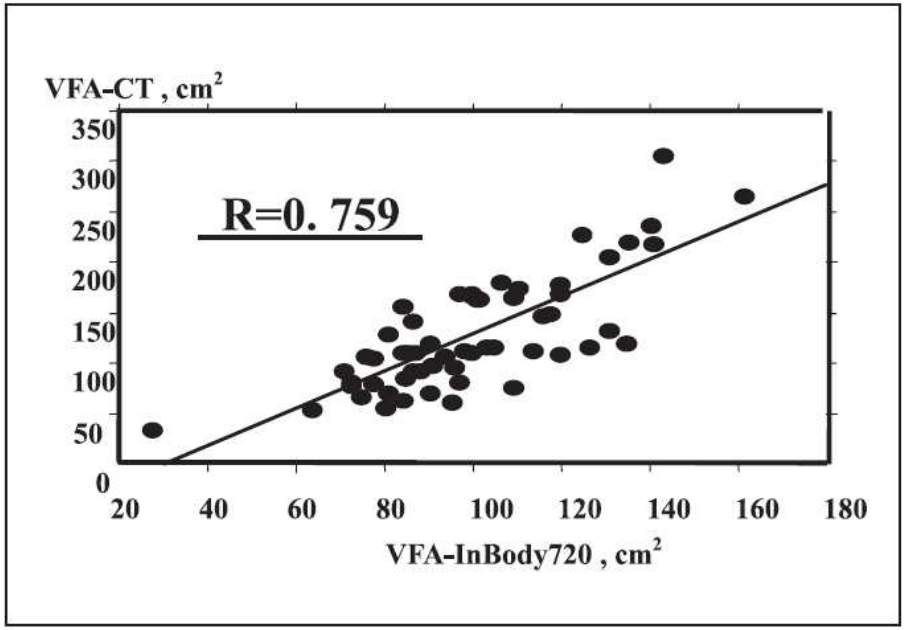

FIGURE 3 A scatter plot of VFA.

Hepato-Gastroenterology 2011; 58:42-44

InBody

www.bodyanalyse.no • www.inbody.no • www.kroppsanalyse.no • dag@bodyanalyse.no