4NBMM DIBOHFT PG IZESBUJPO BOE "JS %JTQM

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Abstract

Background: 'R FXUUHQW OLIH FKDQJHV RI K\GUDWLRQ LQÀXHQFH WKH DVVHVVPHQW FKDQJHV E\ $LU 'LVSODFHPHQW 3OHWK\VPRJUDSK\ $'3 "

Methods: ,Q WHQ QRUPDO VXEMHFWV $'3 PHDVXUHPHQWV ZHUH SHUIRUPHG EHIRUH ZDWHU DQG WKHQ DIWHU PLFWLRQ 7KH DQDO\VLV ZHUH FRQGXFWHG ZLWK WKH V GHQVLW\ DQG / RI D IDW IUHH PLPLFNLQJ VROXWH GHQVLW\

Results: ,QJHVWLQJ DQG FDUU\LQJ / RI ZDWHU OHG WR D VLPLODU VLJQL¿FDQ " NJ FDUULHG " $ VLJQL¿FDQW UHGXFWLRQ RI WKH ERG\ YROXP " / ZLWKRXW DQ\ VLJQL¿FDQW FKDQJH RI ERG\ FRPSRVLWLRQ ,Q WKH PLFWLRQ IDW DQG IDW IUHH ORDGV ZHUH GLVFULPLQDWHG FORVHVW WR UHDOL ZHUH FRUUHODWHG ZLWK WKH WUXH FKDQJHV EXW WKH IDW RI WKH FKDQJHV ZH " S DQG ELDVHG %ODQG $OWPDQ SURFHGXUH WKH PRUH WKH FKDQJH LWV IDWQHVV

Conclusions: $'3 GLVFULPLQDWHV a NJ DOWHUDWLRQV LQ IDW YV IDW IUHH PDVV 7 VLPLODU FRQGLWLRQV RI JRRG K\GUDWLRQ

Keywords: Air Displacement Plethysmography; Hydration; Fat mass; Fat-free mass

Abbreviations: ADP: Air Displacement Plethysmography; BIA: Body Impedance Analysis

Background

e analysis of body composition provides important information on physical status. Numerous physical or isotopic methods are used

*Corresponding author: 9LQFHQW 5LJDOOHDX 1XWULWLRQ 'LD +DXW /pYrTXH DYHQXH GH 0DJHOODQ 3HVVDF %RUGHDX[UXH /pR 6DLJQDW %RUGHDX[ ))D[(PDLO YLQFHQW ULJDOOHDX#ZDQD

Received 1RYHPEHU Accepted -DQXDU\ Published January

Citation: /DXOH\ &*RQ]DOH] &3HUOHPRLQH &*LQ + 5LJDOOHDX9 6PDOO FKDQJHV RI K\GUDWLRQ DQG $LU 'LVSODFHPHQW 3O 7KHU GRL

Copyright: ‹ /DXOH\ &HW DO 7KLV LV DQ RSHQ DFFHVV D WKH WHUPV RI WKH &UHDWLYH &RPPRQV $WWULEXWL XVH GLVWULEXWLRQ DQG UHSURGXFWLRQ LQ DQ\ PH VRXUFH DUH FUHGLWHG

-sun ower oil for the fat load (weight: 0.949 kg, density: 0.90),

-30 g/100 mL glucose solute for the fat-free load (weight: 1.160 kg, density: 1.10).

In each case, a few coins were added to the bottle to adjust its weight and obtain the desired density despite the small in uence of the plastic of the bottle and its cap.

e oral water load (1.055 L, 1.006 kg) was completely ingested by the subjects.

Body composition assessment

Weight was measured as part of the BOD POD procedure. e BOD POD was calibrated for an empty chamber and a known volume (49.771 L cylinder) before each measurement. e subjects were weighed, and then entered the BOD POD chamber, wearing only underclothes and a swimcap. Duplicate measurements of body volume were performed according to the BOD POD manufacturer's recommendations (Life Measurement Instruments, California, USA); a third measurement was performed when they di ered by more than 150 mL. Predicted lung volume was used for the calculation of body volume, using adult-speci c equations [13]. Fat and fat-free mass were

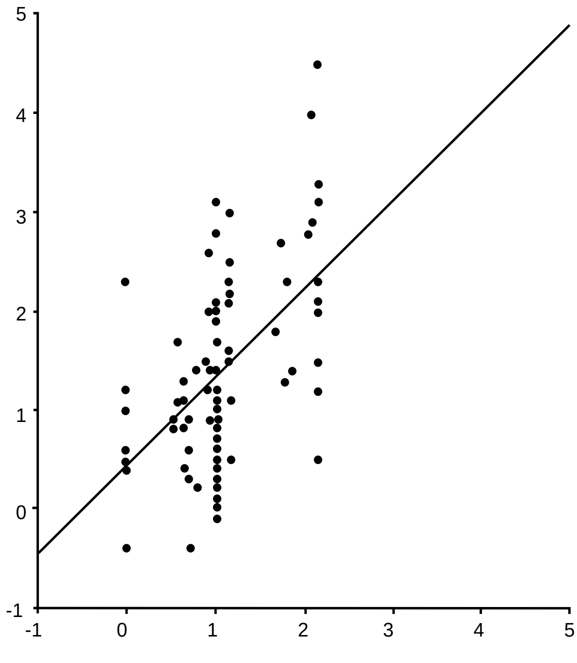
Changes in fat and fat-free mass assessed by ADP. For each of the ten subjects, the composition of 9 distinct loads were analyzed. For the 90 induced alterations in body composition, the mean true change in fat-free mass was +1.07±0.61 kg, and the ADP overestimated it by +1.40±0.97 kg (p<0.001). is measured change of fat-free mass was signi cantly correlated with the true change (r=0.55, p<0.001, Figure 1). e mean true change in fat mass was +0.31±0.45 kg, the ADP underestimated it at +0.02±0.86 kg (p<0.001). is measured change in fat mass was signi cantly correlated with the true change (r=0.41, p<0.001). e mean true %fat of the change was +22.7±34.9%; ADP underestimated it by -3.6±70.8% (p<0.001). is measured %fat change was signi cantly correlated with the true % (Figure 2a: r=0.30, p<0.05), but according to the Bland & Altman procedure it was biased (Figure 2b: 2SD = 136%, r=0.98, p<0.001): the more the change was composed of fat, the less ADP underestimated its fatness. e % hydration of the loads was correlated with the error (r=0.22, p<0.05), but this contribution was no longer signi cant a er taking account of the bias by the Bland & Altman procedure (p=0.38).

E ects of water ingestion and miction on BIA results (Table 3). Due to the large dispersion in the results, no signi cant changes were detected, except a paradoxical reduction in intracellular water a er the ingestion of the water: we considered these results to be aberrant, and did not try to use them to correct the ADP results.

Correlation of fat-free mass with muscular strength. ADP-measured fat-free mass was highly correlated with muscular strength (r= 0.94, p<0.001). Although signi cant, the correlation between BIA-measured fat-free mass was weaker (r=0.75, p<0.05).

Discussion

Our results support the interest of ADP for studying the composition of small body weight changes. e carrying of ~1 kg loads



Real Fat-Free Mass (kg)

led to signi cantly di erent increases in fat (load of 0.9 density) and fat-free mass (load of 1.1 density), as detected by ADP in ten normal subjects. e results would presumably have been the same if the loads had been incorporated to the body of the subjects instead of carried in plastic bottles, as the ingestion of 1.055 L water gave similar results to its addition in an externally beared bottle. ADP therefore discriminates ~1 kg changes in fat from fat-free mass, which improves our previous reports suggesting that ~2 kg changes were discriminated in similar numbers (n=10) of subjects [9,10]. e use of loads of densities calibrated to the postulated densities of fat and fat-free mass instead of

just water and oil as previously, probably explains this better accuracy: although water belongs to fat-free mass, its density is lower than 1.1, so it was less distinguished from fat than the 1.1 density load used in the present study. e use of closed instead of open bottles may also have contributed to the better accuracy, as small volumes of trapped air are known to in uence the ADP results [16]. Short term changes in hydration did not prevent the discrimination of fat from fat-free loads by ADP: the di erences were quite similar before and a er miction, and the ingestion of 1L of water was adequately detected as an increase in fat-free mass. But from the practical point of view of an investigator who wants to determine the composition of a few kg alteration in body weight during a longitudinal study, the results in table 2 indicate that the ADP measurements require similar conditions of hydration for each analysis: a +1 kg fat gain was analyzed as a mainly fat gain a er drinking, and mainly fat-free before. e results in the table 2 also suggest that the best results will be obtained if studying well-hydrated subjects. In such conditions, ADP appears as a quick, safe, clinically usable and reliable tool for studying the composition of snditionds clinictsafe, (measurefe,e89.575itio874076 [(Ou)-1432or)-1-1432ohs c
ofu TD [56(term)3,TD [56(bs.)-[56(ohey)-[56(s)-116(56(id)-1756(exe)ly)-[56(ohe)-[56(sam66(bef56(F)-14556(exemple)-83(1.1,)]TJ 0 -

FKDQJHV LQ OLIHVW\OH DPRQJ VXEMHFWV ZLWK LPSDLUHG JOXFRVH WROHUDQFH 1 (QJO - 0HG

3KHOO DQ:DGGHQ 7$ &RPELQLQJ EHKDYLRUDO DQG SKDUPDFRORJLFDO WUHDWPHQWV IRU REHVLW\ 2EHV 5HV

+HLWPDQQ ,PSHGDQFH D YDOLG PHWKRG LQ DVVHVVPHQW RI ERG\ FRPSRVLWLRQ" (XU - FOLQ 1XWU

HQWRQ .DUVHJDUG 9/ =DZDG\QVNL 6 .\OH 8 3LFKDUG & HW DO &RPSDULVRQ RI ERG\ ZHLJKW DQG FRPSRVLWLRQ PHDVXUHG E\ WZR GLIIHUHQW 'XDO HQHUJ\ ; UD\ DEVRUSWLRPHWU\ GHYLFHV DQG WKUHH DFTXLVLWLRQ PRGHV LQ REHVH ZRPHQ &OLQ 1XWU

)LHOGV *RUDQ 0, 0F&URU\ 0$ %RG\ FRPSRVLWLRQ DVVHVVPHQW YLD DLU GLVSODFHPHQW SOHWK\VPRJUDSK\ LQ DGXOWV DQG FKLOGUHQ D UHYLHZ $P - &OLQ 1XWU

*LQGH 6 *HOLEWHU $ 5XELDQR) 6LOYD $0 :DQJ - HW DO $LU GLVSODFHPHQW SOHWK\VPRJUDSK\ YDOLGDWLRQ LQ RYHUZHLJKW DQG REHVH VXEMHFWV 2EHV 5HV

6HFFKLXWWL)RXU & 3HUOHPRLQH & *LQ + 'XUULHX - HW DO $LU GLVSODFHPHQW SOHWK\VPRJUDSK\ FDQ GHWHFW PRGHUDWH FKDQJHV LQ ERG\ FRPSRVLWLRQ (XU - &OLQ 1XWU

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