

## The impact of image and performance enhancing drugs on bi-ventricular structure and function in strength-trained athletes and the association to fat-free mass

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**Background:** Image and performance enhancing drugs (IPED) cause cardiac enlargement and dysfunction. Previous work has not assessed impact of user status (current [CU] vs. past [PU]) or allometric scaling cardiac dimensions for individual differences in fat-free mass (FFM).

**Purpose:** To investigate CU and PU of IPED and allometric scaling on LV and RV remodeling in strength-trained athletes.

**Methods:** Thirty-four (29 ± 6 years; 82% male) strength-trained athletes were recruited. Fourteen were CU, 9 PU and 11 non-users (NU) of IPEDs. Participants underwent bioelectric impedance body composition analysis, IPED and training questionnaire and 2D echocardiography with strain imaging. All structural data was allometrically scaled to FFM according to the laws of geometric similarity.

**Results:** CU and PU had significantly higher FFM compared to NU (82.4 ± 10.1 kg vs. 72.0 ± 6.3 kg vs. 58.2 ± 14.0 kg). Absolute values of all RV and LV size were larger between CU and NU. LV mean wall thickness (MWT) was larger in CU compared to PU but there were no differences between PU and NU. Allometric scaling eliminated all differences with exception of LV mass and LVMWT. LVEF was significantly lower in CU and PU compared to NU (55 ± 3 vs. 57 ± 4 vs. 61 ± 4) whilst LV GLS was lower in CU compared to PU and NU and LV GCS was lower in CU compared to NU but not PU. There was no significant difference between groups for RV functional indices.

**Conclusion:** Strength-trained athletes currently using IPEDs have bi-ventricular enlargement as well as reduced LV function. Allometric scaling highlights that increased size is partially associated with a larger FFM, with exception of LVMWT which is independently increased through IPED use. PUs demonstrate reverse structural remodeling whilst functional differences partially remain.

	CU	PU	NU
RVD1 (mm)	45 ± 5*	43 ± 6	37 ± 6
Scaled RVD1 (mm/kg <sup>0.33</sup> )	10.5 ± 0.9	10.4 ± 1.5	9.7 ± 1.0
LVd (mm)	58 ± 7*	55 ± 4	50 ± 4
Scaled LVd (mm/kg <sup>0.33</sup> )	13.4 ± 1.2	13.3 ± 0.7	13.1 ± 0.6
MWT (mm)	10 ± 1* <sup>”</sup>	8 ± 1	8 ± 1
Scaled MWT (mm/kg <sup>0.33</sup> )	2.3 ± 0.2* <sup>”</sup>	2.0 ± 0.1	2.0 ± 0.2
LVEDV (ml)	169 ± 42*	135 ± 28	116 ± 28
Scaled LVEDV (ml/kg)	2.0 ± 0.4	1.9 ± 0.3	2.0 ± 0.2
LV Mass (g)	255 ± 85* <sup>”</sup>	179 ± 30	137 ± 40
LV mass index (g/kg)	3.1 ± 0.8*	2.5 ± 0.3	2.4 ± 0.4

\* CU and NU<sup>”</sup> CU and PU<sup>”</sup> PU and NU

Abstract Figure. Myocardial strain imaging

