Differences in body composition in various wheelchair sports

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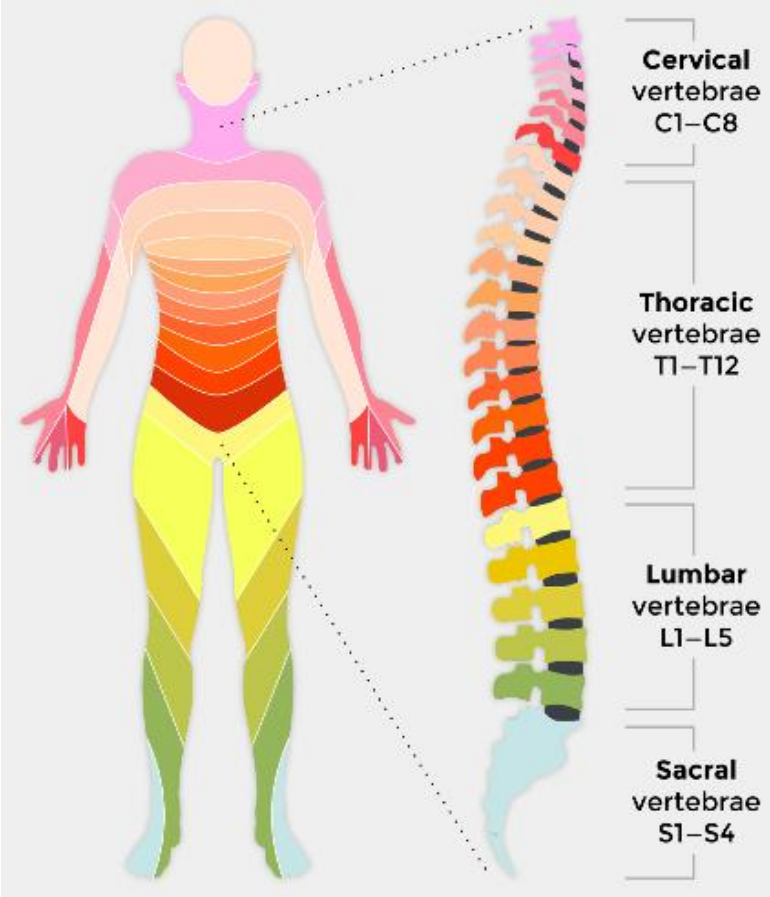
Body composition after an SCI

- Decrease in muscle mass and
- Increase in fat mass
- Increase in body fat percentage

- Spasticity prevents loss of muscle mass in paralyzed regions



Assessment of body composition in SCI

- *“Results showed that the predictions of %fat when using BIA, ADP or skinfolds **systematically underestimated the %fat** mass as measured by the DXA”*
  (Goosey-Tolfrey et al. 2016)

- *“DXA provides **good short-term precision** in whole body and segmental analysis of body composition in **elite athletes with disability**” (Keil et al. 2016)*

- Segmental assessment of body composition in SCI needed
- DXA is the most accurate method for SCI at the moment

Methods

- **Retrospective analysis** of DXA scans in elite wheelchair athletes of various sports
- DXA scans were performed at the **yearly medical check-up**
- Medical data form clinic internal system: upper extremity motor score (UEMS), motor level of the injury (MLI)
- Normally distributed data (overall), not normally distributed between different sports → t-Test and Kruskal-Wallis test/Mann-Whitney-U test
- Statistical significance → set at α-level of 0.05

Results: characteristics of the athletes

Group	N	Age [y]	Body mass [kg]	Height [cm]	Time since injury [y]
Paracycling	11	34 ± 11	60.5 ± 10.8	172.3 ± 10.1	19.3 ± 11.8
Rugby	14	31 ± 6	71.7 ± 18.5	178.1 ± 11.0	14.2 ± 8.4
Basketball	6	33 ± 10	70.2 ± 10.8	172.5 ± 12.0	25.8 ± 0.4
Athletics	13	26 ± 8	53.2 ± 12.0	161.8 ± 15.8	21.2 ± 10.8
Curling	6	51 ± 2	74.9 ± 8.9	172.7 ± 3.6	23.1 ± 10.2
Court sports	8	35 ± 15	64.0 ± 13.6	166.6 ± 11.1	19.8 ± 15.8
Others	10	32 ± 13	67.9 ± 12.5	164.7 ± 14.9	13.0 ± 5.3
Men	49	34 ± 11	68.9 ± 13.7	175.3 ± 9.7	19.0 ± 11.4
Women	20	32 ± 12	56.4 ± 14.1	156.7 ± 17.4	19.1 ± 7.3
Paraplegia	36	35 ± 13	62.9 ± 13.0	168.4 ± 12.6	21.2 ± 10.9
Tetraplegia	19	34 ± 8	71.5 ± 16.9	178.1 ± 9.1	15.5 ± 9.4
Non-SCI	14	30 ± 12	62.2 ± 14.7	162.4 ± 21.2	15.7 ± 0.9
Total	**69**	**33 ± 11**	**65.1 ± 14.8**	**169.9 ± 14.9**	**19.0 ± 10.5**

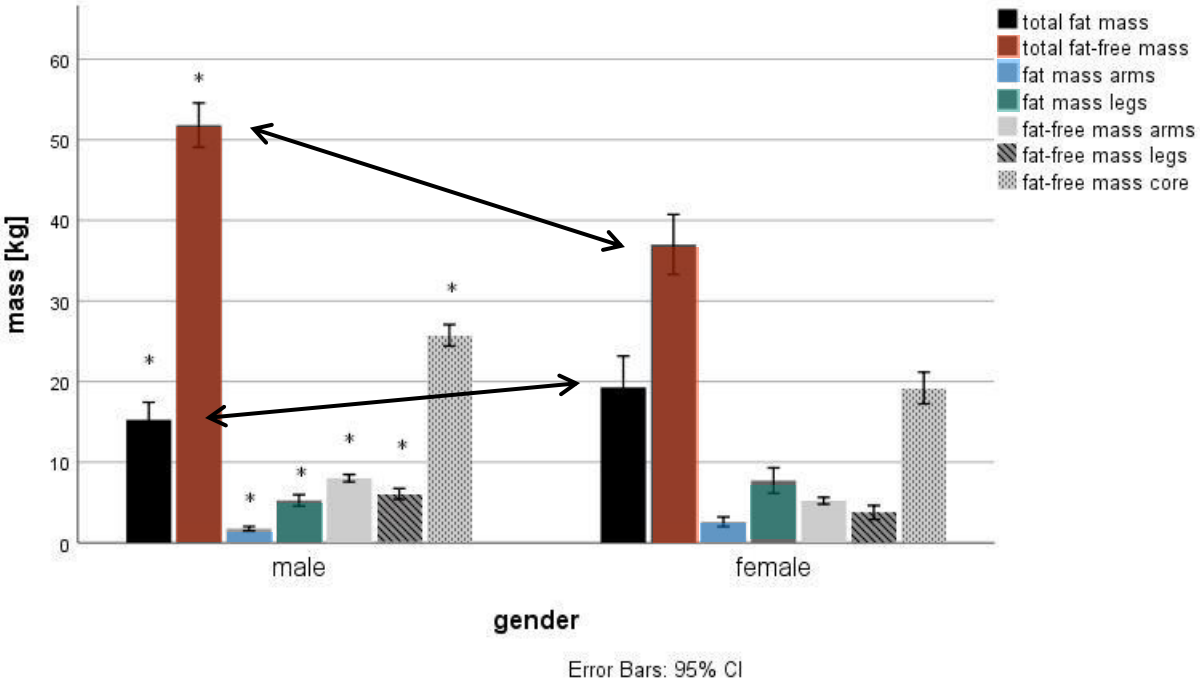
Results: FFM and FM in different wheelchair sports

Group	N	Fat-free mass [kg]			Fat mass [kg]		
		Arms	Legs	Trunk	Arms	Legs	Trunk
Paracycling	11	7.8 ± 2.0	10.1 ± 4.2	22.6 ± 3.4	1.4 ± 0.8	5.0 ± 2.8	5.2 ± 3.4
Rugby	14	7.0 ± 1.6	14.1 ± 4.1 *	25.7 ± 5.5	1.9 ± 1.2	5.8 ± 2.9	8.0 ± 5.2
Basketball	6	9.0 ± 1.0	13.1 ± 5.5 *	27.6 ± 4.4	1.7 ± 0.9	4.6 ± 1.9	7.4 ± 4.7
Athletics	13	6.6 ± 2.4	6.9 ± 3.8	20.5 ± 6.2	1.8 ± 0.8	5.4 ± 2.4	5.8 ± 2.4
Curling	6	7.6 ± 1.5	10.4 ± 2.8	26.0 ± 3.3	2.9 ± 0.9	8.7 ± 2.4	12.7 ± 3.8 *
Court sports	8	6.3 ± 1.4	10.4 ± 3.9	22.4 ± 5.0	2.5 ± 0.9	7.1 ± 3.8	7.8 ± 4.8
Others	10	7.2 ± 2.0	10.5 ± 5.3	24.7 ± 5.3	2.2 ±1.0	6.5 ± 2.8	7.8 ± 3.5
Total	**69**	**7.2 ± 1.9**	**10.7 ± 4.8**	**23.9 ± 5.3**	**2.0 ± 1.1**	**6.0 ± 2.9**	**7.5 ± 4.4**

No significant difference in fat percentage between the groups

Highest fat percentage (>40 %) in the legs in athletics (low muscle mass, similar fat mass)

Results: male vs. female athletes



Females:

- Lower muscle mass
- Higher fat mass

Results: FFM in the arms (tetraplegia)

Participant	Lesion level	MLI		Sport	Fat-free mass (kg)		Difference (g)	UEMS		Dominant side	Congruence
Incomplete lesion		Right	Left		Right arm	Left arm	Right vs. Left	Right	Left		
1	C2	C5	C3	Athletics	3.06	2.43	636.3	20	14	Right	☑
2	C4	C6	C6	Rugby	2.63	2.75	112.0	11	11	no	☑
3	C5	C5	C7	Paracycling	3.65	4.10	450.3	14	20	Left	☑
4	C5	C6	C6	Rugby	2.61	2.47	140.1	9	16	Left	☒
5	C5	n.a.	n.a.	Rugby	4.82	4.28	540.2	n.a.	n.a.	n.a.	n.a.
6	C5	C7	C7	Rugby	4.21	3.83	372.5	23	20	Right	☑
7	C5	C7	C6	Athletics	3.39	2.79	598.0	19	13	Right	☑
8	C5	C6	C5	Athletics	5.35	5.37	17.6	20	19	no	☑
9	C6	C7	C8	Rugby	2.86	3.01	141.1	18	23	Left	☑
10	C6	C8	C7	Rugby	4.81	4.18	627.7	24	23	Right	☑
11	C6	C8	C7	Rugby	3.33	3.02	307.8	19	15	Right	☑
12	C6	n.a.	n.a.	Rugby	3.73	3.47	256.2	n.a.	n.a.	n.a.	n.a.
13	C6	n.a.	n.a.	Rugby	4.70	3.85	843.9	n.a.	n.a.	n.a.	n.a.
14	C6	n.a.	n.a.	Rugby	4.38	4.15	238.1	n.a.	n.a.	n.a.	n.a.
15	C7	C7	C7	Athletics	2.88	3.70	824.2	19	19	no	☒
16	C8	C8	C8	Rugby	3.75	3.70	53.2	22	19	Right	☑
Mean ± SD					**3.76 ± 0.87**	**3.57 ± 0.79**	**305.4 ± 361.6**	**18.1 ± 4.6**	**17.7 ± 3.8**		
Complete lesion											
17	C6	C6	C6	Paracycling	3.87	3.84	28.5	11	14	Left	☒
18	C6	T1	C8	Paracycling	3.39	2.97	415.4	24	19	Right	☑
19	C6	C6	C6	Rugby	3.83	3.18	643.9	10	10	n.a.	☒
20	C7	C7	C5	Rugby	3.84	3.58	262.7	24	16	Right	☑
Mean ± SD					**3.39 ± 0.39**	**3.73 ± 0.23**	**337.6 ± 258.9**	**17.2 ± 6.7**	**14.8 ± 3.8**		

Conclusion

- **Sport-specific differences** in body composition might occur
- Diffulties to detect due to differences between **gender, lesion level, spasticity, completeness and other injury-related factors**

- **Lower muscle mass, higher fat** mass in female elite wheelchair athletes
- Differences between left and right arm in tetraplegic athletes migh evolve from differences in **UEMS and MLI**
- Interpretation of body composition in wheelchair athletes → knowledge about physiology/consequences of injury

Thank you for the attention!