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Lower reference limits for semen characteristics

Parameter	Lower reference limit
Semen volume (ml)	1.4
Total sperm number (million per ejaculate)	39
Sperm concentration (million per ml)	16
Progressive motility (PR, %)	30
Sperm morphology (normal forms, %)	4
Vitality (live spermatozoa, %)	54
pH	7.2

Distribution of semen examination results from men in couples starting a pregnancy within one year of unprotected sexual intercourse leading to a natural conception. From Campbell et al. (5); fifth percentile given with variability (95% confidence interval)

Parameter (units)	N	Centile									
		2.5th	5th	(95% CI)	10th	25th	50th	75th	90th	95th	97.5th
Semen volume (ml)	3586	1.0	1.4	(1.3-1.5)	1.8	2.3	3.0	4.2	5.5	6.2	6.9
Sperm concentration (million/ml)	3587	11	16	(15-18)	22	36	66	110	166	208	254
Total sperm number (million per ejaculate)	3584	29	39	(35-40)	58	108	210	363	561	701	865
Progressive motility (PR, %)	3389	24	30	(29-31)	36	45	55	63	71	77	81
Non-progressive motility (NP, %)	3387	1	1	(1-1)	2	4	8	15	26	32	38
Immotile spermatozoa (IM, %)	2800	15	20	(19-20)	23	30	37	45	53	58	65
Vitality (%)	1337	45	54	(50-56)	60	69	78	88	95	97	98
Normal forms (%)	3335	3	4	(3.9-4.0)	5	8	14	23	32	39	45

Source: WHO laboratory manual for the examination and processing of human semen, Sixth Edition (2021).