

Table 150. Tensile properties of fallen hair

Animal	Tensile Breaking Load (g)	Ultimate Tensile Strength (kg/mm ²)	Ultimate Percentage Elongation
Lions	150	15	40
Tigers	120	28	34
Bears	270	30	33
Brown bears	160	27	35
Camels	95	20	36
Deer	200	20	36
Goats	180	22	37
Antelopes	270	20	45
Wolves	250	20	40
Badgers	150	20	28
Foxes	170	21	35
Dogs	170	22	36
Cats	140	27	32
Orangutans	150	27	38
Monkeys	170	20	39
Martens	120	20	34
Raccoon dogs	110	28	37
Angora rabbits	80	18	25

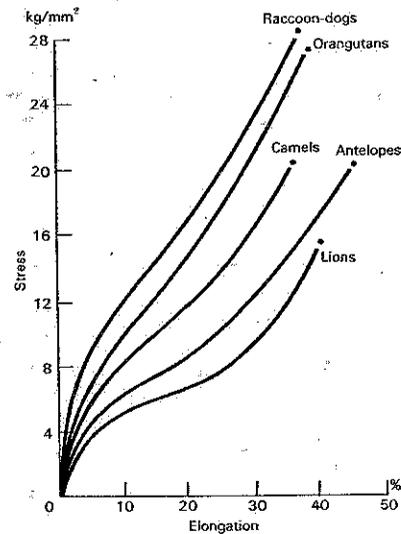


FIG. 212. Stress-strain curves in tension of the hair of various animals.

an ultimate elongation similar to that of the middle group.

Fig. 212 shows the stress-strain curves for hair from various animals.

The percentage of elastic recovery is 60%, just before rupture and immediately after removal of stress, and 75% with the elastic aftereffect.

REFERENCE

Endo, N.: Study on the strength of the human hair and the mammal hair. J. Kyoto Pref. Med. Univ., 58: 373-389, 1953.

7.5.2. Extractive Properties of the Hair

7.5.2.1. Extractive Properties of Human Hair (Table 151). The extractive properties of the head hair of 69 persons were studied by Tsuda (1957); of axillary hair of 77 persons and pubic hair of 86 persons by Bessho and Okamoto (1960); and of eyebrows and eyelashes of 30 persons by Sato (1960). All subjects were living.

The extractive load of head hair is greatest in the 20 to 29 age group but declines to 87% of its maximum after 50 years of age. There is no significant difference between the extractive load of black and white hair.

Axillary hair has an extractive load that is greatest between 20 and 49 years of age but, after 60 years of age, it is only 73% as great. The extractive load of pubic hair is likewise greatest between 20 and 49 years of age and decreases to 86% after 60 years of age. There is no significant sexual difference in the extractive load of head, axillary, or pubic hair.

Like head hair, the eyebrows have the greatest extractive load in the 20 to 29 age group but, after 40, it is 87% of its former value. The extractive load of eyelashes from the upper eyelid shows no significant change from 10 to 69 years of age but that for lower eyelashes is greatest from 20 to 29 years of age. From 50 to 60 years of age, the load decreases to 78% of its maximum value. There is no significant sexual difference in the extractive load of eyebrows or eyelashes. The extractive load is greatest in head hair and next in pubic hair, axillary hair, the eyebrow, upper eyelash, and lower eyelash.

Table 151. Extractive properties of human hair

Hair	Age Group							Adult Average
	10-19 yr	20-29 yr	30-39 yr	40-49 yr	50-59 yr	60-69 yr	70-79 yr	
<i>Extractive Load (g)</i>								
Head	65.0 ±10.2	72.3 ±4.5	70.1 ±2.6	65.0 ±2.0	63.2 ±7.6	63.2 ±7.6	—	66.8
Axillary	—	41.7 ±0.9	41.7 ±0.9	41.7 ±0.9	34.4 ±2.2	30.6 ±1.4	30.6 ±1.4	36.8
Pubic	—	65.6 ±1.1	65.6 ±1.1	62.2 ±1.1	62.2 ±1.8	56.5 ±2.5	56.5 ±2.5	62.0
Eyebrow	23.4 ±2.3	26.2 ±1.0	23.5 ±3.2	22.9 ±3.3	22.8 ±1.6	22.8 ±1.6	—	23.6
Eyelash								
Upper	21.6 ±1.9	21.8 ±0.4	19.6 ±1.1	21.2 ±2.1	21.5 ±2.6	21.5 ±2.6	—	21.1
Lower	10.8 ±1.5	13.4 ±0.7	12.9 ±2.2	10.4 ±2.2	10.4 ±1.7	10.4 ±1.7	—	11.9
Ratio								
Head	0.90	1.00	0.97	0.90	0.87	0.87	—	
Axillary	—	1.00	1.00	1.00	0.82	0.73	0.73	
Pubic	—	1.00	1.00	1.00	0.95	0.86	0.86	
Eyebrow	0.89	1.00	0.89	0.87	0.87	0.87	—	
Eyelash								
Upper	1.00	1.00	1.00	1.00	1.00	1.00	—	
Lower	0.80	1.00	0.96	0.94	0.78	0.78	—	

Extractive Load (g) of Head Hair in Cadavers

Room Temperature	Living Body	Postmortem Time in Cadavers								
		10 hr	20 hr	40 hr	60 hr	80 hr	100-140 hr	160-180 hr	200-240 hr	
°C										
10	67	47 ±5.1	27 ±2.5	27 ±2.5	22 ±2.7	22 ±2.7	16 ±2.0	10 ±2.5	3 ±1.7	
20	67	44	24	18	12	8	2	—	—	
Ratio	10	1.00	0.70	0.40	0.33	0.33	0.25	0.15	0.05	
	20	1.00	0.65	0.35	0.27	0.20	0.10	0.03	—	

The relationship of the extractive load of cadaver hair to postmortem time was investigated by Tsuda and Narumiya (1957). Values and ratios are found in Table 151.

REFERENCES

- Bessho, I. and S. Okamoto: The extractive strength of human axillary and pubic hairs. J. Kyoto Pref. Med. Univ., 68: 1325-1328, 1960.
 Sato, M.: The extractive strength of human eyebrows and cilia. J. Kyoto Pref. Med. Univ., 67: 1405-1408, 1960.
 Tsuda, K.: Study on the extractive strength of human head hairs. J. Kyoto Pref. Med. Univ., 61: 936-940, 1957.
 Tsuda, K. and S. Narumiya: Study on the decision

of the postmortem hours by the extraction test of head hairs. J. Kyoto Pref. Med. Univ., 61: 997-1000, 1957.

7.6. MECHANICAL PROPERTIES OF THE NAILS

7.6.1. Tensile Properties of the Nails

7.6.1.1. Tensile Properties of Human Nails (Table 152). Katsura and Nose (1959) determined the tensile properties of the nails of 15 persons.

The tensile breaking load per unit width of wet nails, in the longitudinal direction, is greatest at 20 to 29 years of age but, by 70