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振動障害等の防止に係わる作業管理のあり方検討会(第2回)資料

我が国の手腕振動の許容基準の提案基礎データからみたEU振動指令規制値との関連

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1. 我が国の手腕振動の許容基準の提案基礎データ

N. Harada, S. Takahashi, S. Shirono, T. Fujimura, H. Morita, J. Inagaki Occupational Exposure limit for hand-arm vibration of the Japan Society for Occupational Health 9th International Conference on Hand-Arm Vibration, Proceedings, INRS, Nancy, France

a) 我が国の20歳以上の日本人一般集団における白指有症率

日本人一般集団における振動起因性を除く白指有症率は、男性で1～3%、女性で1～4%程度と推測された。

Table 1 - Prevalence of WF excluding that of vibration origin in general population in Japan
(over 20 years of age)

ref	number of subjects		range of age		prevalence of WF	
	male	female	male	female	male	female
Harada et al, 1991	1875	1998	20-69	20-69	1.4%	1.9%
Inaba et al, 1989	149	262	20-89	20-89	1.3%	1.5%
Mirbod et al, 1994	1027	1301	30-59	30-59	2.7%	3.4%

average and 95%CI by merging three data: male:1.9%(1.4-2.3%), female:2.4%(1.9-2.9%)

Table 2 - Prevalence of WF excluding that of vibration origin according to age in
general population in Japan (Harada et al, 1991, Mirbod et al, 1994)

age	prevalence of WF (95%CI)	
	male	female
30-39	1.1% (0.3-1.9%)	3.1% (1.5-4.6%)
40-49	2.3% (1.2-3.3%)	3.0% (1.8-4.2%)
50-59	2.3% (1.3-3.4%)	2.3% (1.5-3.2%)

b)低振動暴露集団における白指有症率

Table 3 - Prevalence of WF among male workers exposed to low magnitude of hand-arm vibration in Japan

ref	tools/ machines	weighted acceleration (single axis)	average exposure		prevalence of WF
			hrs/day	years	
Mirbod et al, 1994	digging ^{a)}	1.6-2.1m/s ²	5	22	2.5%
Mirbod et al, 1994	aircraft ^{b)}	2.3-2.5m/s ²	4	17	2.3%
Mirbod et al, 1994	chain-saw	2.7-5.1m/s ²	3	19	9.8%
Tominaga, 1995	motor-cycle	1-2m/s ^{2 c)}	4 ^{c)}	12	1.8%
Tominaga, 1995	motor-cycle	2-3m/s ^{2 c)}	4 ^{c)}	12	3.0%
Matsumoto et al, 1981	motor-cycle	1.6m/s ²	2.5	9.7	2.7%
Futatsuka et al, 1984	various	3.2m/s ^{2 c)}	4 ^{c)}	10	5.0% ^{d)}
Futatsuka et al, 1984	various	3.2m/s ^{2 c)}	4 ^{c)}	16	12.8% ^{d)}

^{a)}:job, ^{b)}:factory, ^{c)}:equivalent value for 4 hrs, ^{d)}:estimated value theoretically.

c)白指有症率と振動暴露年数、振動強度との関連

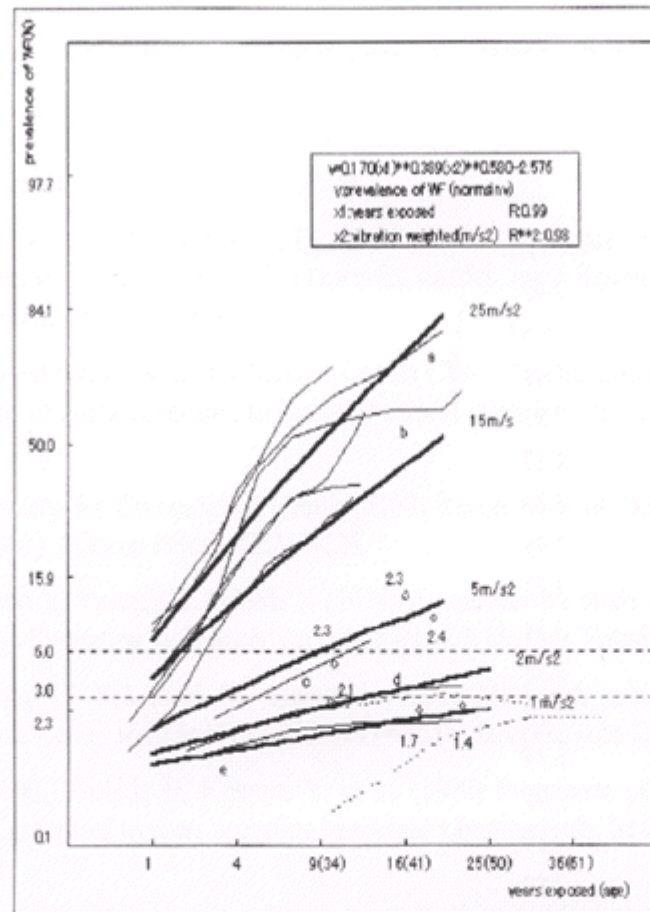


Figure 1: Relation between prevalence of white finger and years exposed to hand-arm vibration. All data are from Japanese males. Thin lines indicate the results of individual studies^{1,3,8,11,12}. Thick lines indicate estimated curves using five studies with vibration values (a:rock-drill⁸, b:chipping-hammer⁸, c:bush-cutter¹, d:motor-cycle¹¹, e:motor-cycle⁵). Symbols (\diamond) indicate the relation between prevalence of WF and average years exposed to low magnitude of hand-arm vibration exposure^{2,9,10}; the values of vibration magnitude without unit are also indicated next to the symbols. Dotted lines indicate the prevalence of white finger excluding that of vibration origin in the general population^{4,10}. Figures in the parentheses of the abscissa indicate age for the general population. The magnitudes of vibration are 8 hours energy equivalent values for a single axis.

白指有症率と振動暴露年数、振動強度との関連式

$$\text{Normsinv}(p) = 0.170(\text{years})^{**}0.389(\text{Vibration})^{**}0.580 - 2.576$$

P=VWF有症率 years: 振動暴露年数 Vibration: 振動強度 (短軸)

振動暴露年数が10年間で、白指有症率が3%を超えない振動レベルを求めた。

Years = 10(年) Vibration = 2.0(m/s²) の場合

$$0.170(10)^{**}0.389(2.0)^{**}0.580 - 2.576 = -1.954 \quad p = 2.6\%$$

振動加速度3軸合成のための係数は、1.4倍を使用。

$$2.0 \times 1.4 = 2.8 \text{ (m/s}^2\text{)}$$

として、許容基準値2.8 (m/s²)が提案された。

2. EU指令のvibration action value (2.5 m/s²)およびvibration limit value (5.0 m/sec²)の場合のVWF有症率の発症予測 (振動暴露年数10年の場合)

Vibration action value (2.5 m/s²) の場合

Years = 10 Vibration = 1.79 (=2.5÷1.4)

$$0.171(10)^{**}0.389(1.79)^{**}0.580 - 2.576 = -1.993 \quad p=2.3\%$$

Vibration limit value (5.0 m/s²)の場合

Years = 10 Vibration = 3.57 (=5.0 ÷ 1.4)

$$0.171(10)^{**}0.369(3.57)^{**}0.580 - 2.576 = -1.706 \quad p=4.5\%$$

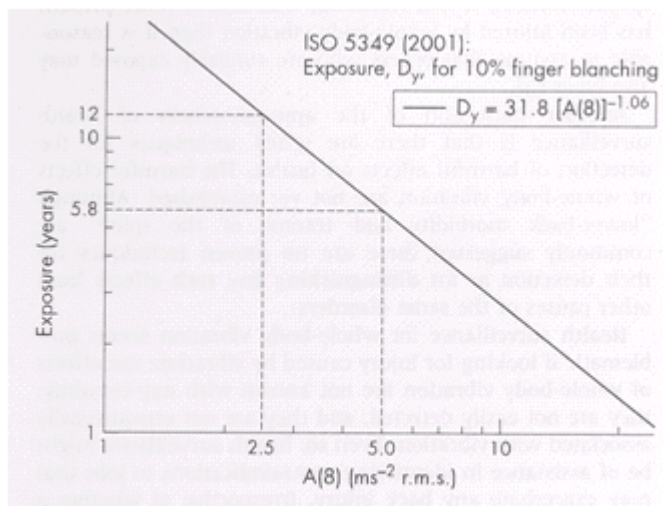


Figure 5 According to ISO 5349 (2001), a 10% probability of finger blanching is predicted after 12 years at the exposure action value and after 5.8 years at the exposure limit value.

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