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Nutritional Assessment for the Elderly

- Recent Studies in Japan -

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Introduction

Protein-energy malnutrition(PEM) is a critical issue in the elderly, because it affects their quality of life(QOL) as well as their outcome. It has been previously reported that about a half of elderly inpatients are in PEM(Mowe et al. 1994). Therefore, appropriate nutritional assessment is necessary for the appropriate nutritional assessment is necessary for the improvement of their nutritional status. Anthropometry is an easy method for nutritional assessment. Recently, Japanese Society for Nutritional Assessment announced a new anthropometric reference data(Japanese anthropometric reference data 2001 : JARD 2001). It consists of more than 5000 healthy subjects in Japan. Aminograms, another nutritional assessment, revealed low plasma branched-chain amino acids(BCAA) in the elderly. It could be the cause of hypoalbuminemia, leading to their poor prognosis in the elderly.

We here in discuss these two methods of nutritional assessment recently reported in Japan.

1. JARD 2001

Anthropometry is a useful method to assess patients' nutritional status at beside. In Japan, Kim Data(Kim et al. 1982) has been used to standarize patients' data. However, in recent twenty years, Japanese body composition has changed(increased fat mass) due to westernization of food style, namely increased fat intake. Another point is that Kim data covered only 87 subjects over 60 years old in 4791 subjects. For this reason, Japanese Society for Nutritional Assessment organized a committee for new anthropometric reference data(chairman : Prof. Hisataka Moriwaki) in 2000.

Seven organizations(Dynabot, Japanese Health & Welfare Ministry, and 5 medical universities) joined this project. 'Healthy subject' is defined as either subjects without disease, or subjects who have minor disease with normal activities of daily living(ADL). ADL is evaluated with Barthel index. Anthropometric parameters are statue, weight, body mass index(BMI), midarm circumference(MAC), calf circumference(CC), triceps skinfold thickness(TSF), subscapular skinfold thickness(SSF), midarm muscle circumference (AMC), and midarm muscle area(AMA). Total numbers of 5492 healthy subjects were collected and analyzed at every 5 years old. An example of the data is shown in Table 1 and Fig. 1.

When the changes of each parameter through ages are compared on graphs, the line of MAC follows the line of BMI(Fig. 2). In contrast, the lines of CC and AMA stay below the line of BMI over 60 years old(Fig. 2, Miwa et al. 2001). These results suggests that muscle volume at upper and lower limbs decrease rapidly in the elderly, and anthropometric parameters such as CC and AMA might reflect this change, while MAC reflects general weight balance. Sarcopenia is a serious problem in the elderly, because it affects their QOL. Anthropometry is an easy method to detect loss of muscle volume and to prepare appropriate nutritional therapy for the elderly.

2. BCAA in the elderly

Poor nutrition is a well recognized problem in elderly population. It has been reported that a low level of serum albumin is a predictive risk factor for mortality from all-causes in the elderly(Corti et al. 1994). The mechanism of hypoalbuminaemia remains unclear, but the most likely explanation is a low protein intake. Low plasma levels of branched-chain amino acids(BCAA) have been reported in the elderly previously(Polge et al. 1997), which could lead to hypoalbuminemia, as a sufficient concentration of BCAA is required for synthesis and secretion of albumin in the liver(Okuno et al. 1995). Low serum albumin also reflects a poor prognosis in patients with chronic liver disease, and oral administration of BCAA in these patients raises serum

Table 1. Anthropometric parameters in JARD 2001

	Age (y)	Weight (kg)	AMC (cm^2)	TSF (mm)
Male	Total	67.72 ± 10.42	45.16 ± 10.22	15.80 ± 6.44
	60 – 64	60.92 ± 8.52	43.46 ± 9.31	13.07 ± 4.08
	65 – 69	60.55 ± 8.20	46.06 ± 9.38	18.26 ± 7.11
	70 – 74	57.82 ± 9.03	43.97 ± 10.21	16.48 ± 6.82
	75 – 79	55.99 ± 8.83	41.37 ± 9.57	15.81 ± 6.52
	80 – 84	54.24 ± 9.40	38.22 ± 10.07	14.57 ± 6.85
	85 –	50.80 ± 10.10	35.44 ± 8.90	11.83 ± 6.30
Female	Total	50.80 ± 8.48	33.15 ± 8.47	17.49 ± 8.23
	60 – 64	51.96 ± 8.05	35.35 ± 9.93	16.09 ± 8.89
	65 – 69	52.55 ± 8.06	32.72 ± 7.61	23.23 ± 8.81
	70 – 74	49.26 ± 8.43	33.20 ± 8.57	19.57 ± 8.48
	75 – 79	47.32 ± 8.36	32.69 ± 8.60	16.22 ± 7.61
	80 – 84	44.23 ± 8.44	31.84 ± 8.06	15.09 ± 7.39
	85 –	40.62 ± 6.55	29.37 ± 8.79	11.92 ± 5.75

Mean ± SD

albumin level and improves their prognosis (Yoshida et al. 1989). The study was conducted to investigate the relationship between BCAA and hypoalbuminemia in the elderly patients.

Thirty elderly subjects aged over 70 years (mean age 84 ± 6, male / female : 6 / 24) were recruited. The elderly subjects were long-term residents of a nursing home as a result of minor brain infarction or dementia. On entry to the study, triceps skinfold thickness (TSF) and arm-muscle circumference (AMC) were measured to assess patients' total volume of body fat and muscle, respectively, and %TSF and %AMC of Japanese elderly population (Kim et al. 1982). Blood samples were taken in the morning after an overnight fast, and serum albumin (Alb), transferrin (Tf), prealbumin (PA), retinal-binding protein (RBP) and plasma

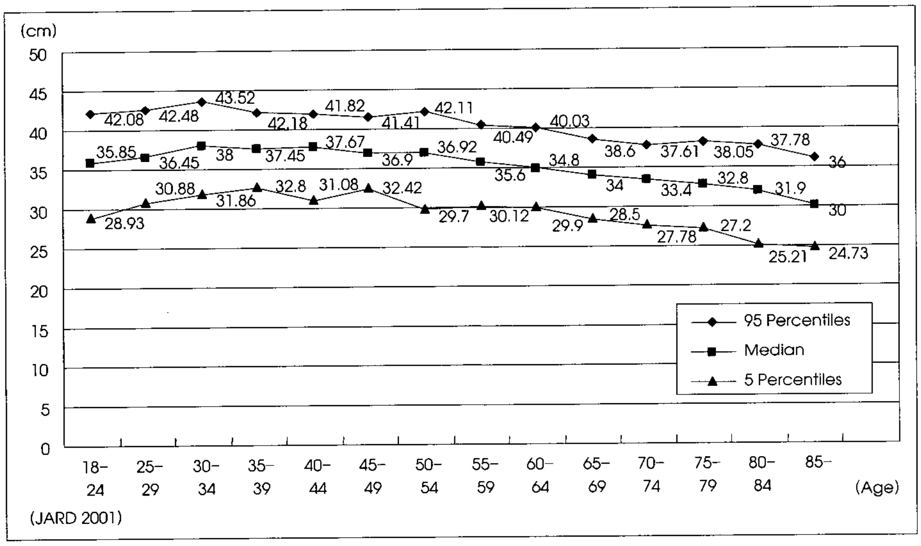

Fig. 1. Anthropometric data of healthy subjects (male calf circumference).

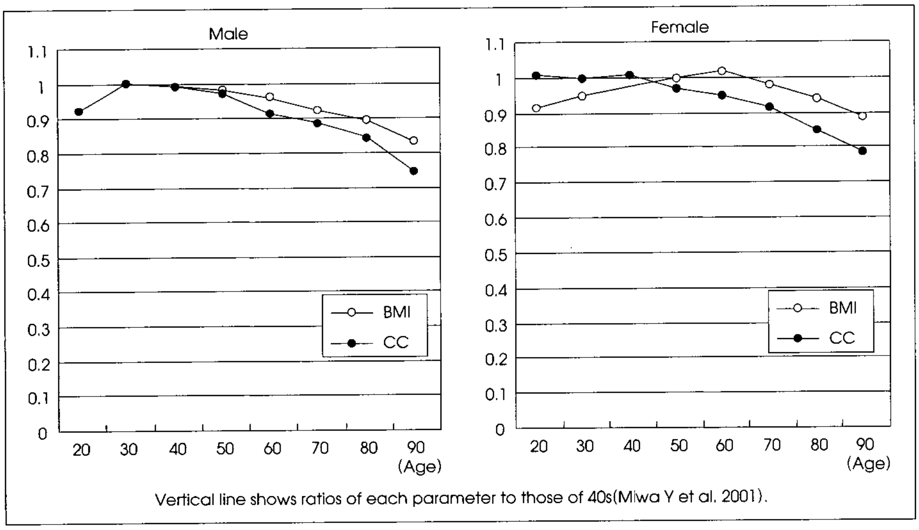

Fig. 2. Change of ratio in calf circumference through ages.

free amino acid levels were determined.

Reduced lower body mass index (BMI), %TSF, and %AMC were observed in the elderly patients, reflecting that the elderly patients had protein-energy malnutrition (Table 2). Serum albumin, transferrin, and prealbumin, were also reduced (Table 3). BCAA, namely valine, leucine and isoleucine, and a molar ratio of BCAA to aromatic amino acids (BAR) were significantly lower in the elderly than in the reference group of te healthy middle-age subjects (Table 4).

Although there was no significant correlation between serum albumin and age, a significant correlation was observed between albumin and BAR in the elderly patients studied (Fig. 3). There was also a significant correlation between %AMC was observed ($r = 0.59$, $p < 0.01$). No correlation was observed among these values in the reference group (Miwa et al. 2000).

This study demonstrated low serum levels of BCAA as well as low serum albumin in the elderly. This result suggests that the elderly subjects, even without severe illness, are in a state of protein-energy malnutrition. Moreover, a significant correlation was observed between serum albumin and BAR. There was also a significant correlation between %AMC and BAR. These results suggest that low serum albumin and reduced muscle volume in the elderly could be due to and absolute or relative decrease of BCAA. It is possible that the administration of BCAA to the elderly would increase serum albumin level and muscle mass, thus leading to improved long-term health.

Table 2. Anthropoemtric parameters in elderly subjects

	Male (n=6)	Female (n=24)
Age (y)	84.3 ± 6.5	83.5 ± 6.5
BMI	19.3 ± 3.0	20.4 ± 3.9
AC (cm)	23.0 ± 3.2	22.0 ± 3.1
TSF (mm)	6.7 ± 2.1	10.6 ± 4.8
%TSF	80.5 ± 20.5	50.4 ± 22.9
AMC (cm)	20.5 ± 2.7	18.6 ± 1.9
%AMC	82.7 ± 11.1	88.7 ± 9.2

(Miwa et al. 2000)

Table 3. Nutritional parameters in elderly subjects

	Male (n=6)	Female (n=24)	Normal range
Total protein (g/dl)	6.9 ± 0.3	7.1 ± 0.6	6.5 – 8.2
Albumin (g/dl)	3.4 ± 0.2	3.6 ± 0.3	3.9 – 4.9
Prealbumin (mg/dl)	23.7 ± 9.0	25.5 ± 5.5	22.0 – 49.0
Transferrin (mg/dl)	199.5 ± 19.1	222.4 ± 48.8	220 – 436
RBP (mg/dl)	4.0 ± 1.5	4.1 ± 0.9	2.8 – 7.6

(Miwa et al. 2000)

Table 4. Plasma BCAA concentration in elderly subjects

	Controls (n=10)	Elderly subjects (n=30)	p value
Val	2634 ± 43.3	231.5 ± 38.5	< 0.05
Leu	151.0 ± 32.3	128.8 ± 25.1	< 0.05
Ile	85.0 ± 18.9	70.6 ± 13.6	< 0.05
Tyr	68.8 ± 10.6	70.9 ± 13.8	NS
Phe	60.0 ± 7.1	66.8 ± 8.9	NS
Total BCAA	499.4 ± 92.4	430.9 ± 74.1	< 0.05
BAR	3.87 ± 0.36	3.17 ± 0.56	< 0.01
Total AA	3376.8 ± 1365.2	3231.7 ± 1296.9	NS

Nmol/ml, NS : not significant (Miwa et al. 2000)

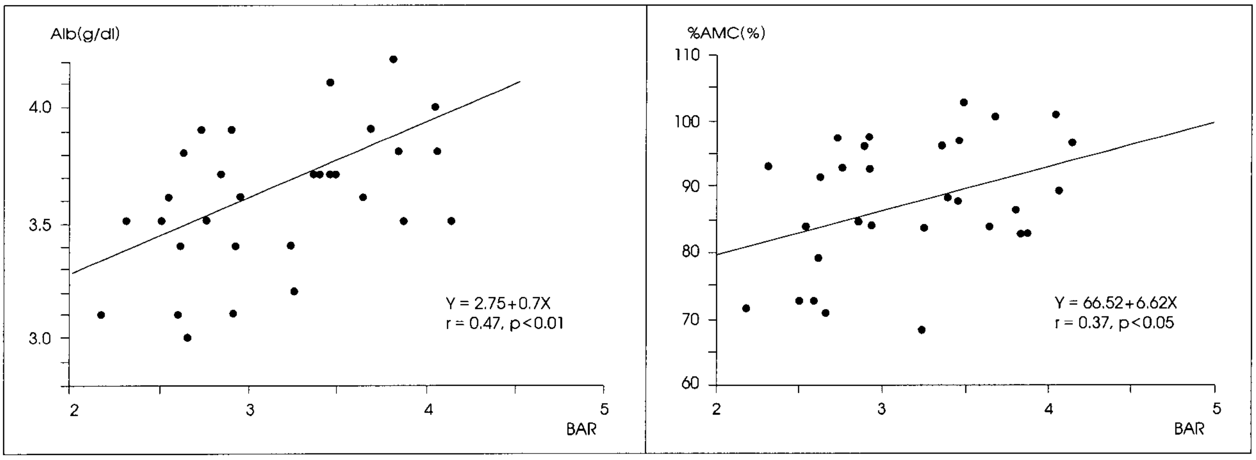

Fig. 3. Correlation between BAR and serum albumin, %AMC in elderly subjects.

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