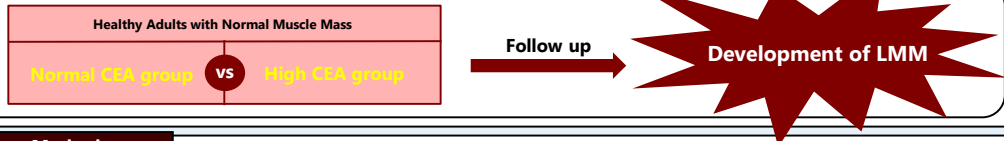


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Introduction

- Carcinoembryonic antigen (CEA) : a fetal glycoprotein which can be elevated not only colorectal cancer
- Previous studies : significant relationship with benign, chronic inflammatory conditions (rheumatoid arthritis, benign lung disease, etc.)
- Park et al. (J Clin Med 2022) : Strong association between CEA level and low muscle mass (LMM) in healthy adults (cross-sectional) → *no longitudinal design*

Purpose of this study



Methods

- Prospective cohort study from the Health Screening Center of Kangbuk Samsung Hospital
- Mean follow duration of participants (years±SD) : 3.87±1.65 in men and 3.66±1.66 in women
- Study Participants
- 216,321 participants without baseline LMM in the Kangbuk Samsung Cohort Study from 2019 were included.
- (1) History of cancer, (2) history of cardiovascular disease, and (3) history of stroke were excluded.
- Participants were grouped into 'normal CEA' or 'high CEA' group (high CEA level was defined as ≥5 ng/mL)
- The development of LMM was defined as SMI<7.0 in men and SMI<5.7 in women, respectively (AWGS).
- Statistical Analysis
- Cox proportional hazards regression analysis : incidence of LMM were shown as hazard ratios (HR) and 95% confidence intervals (CI)

Results

Table 1. Basal characteristics of study subjects classified by sex.

	Total	Men	Women	P value
Number of subjects (n)	216,312	131,497	84,815	
Age (years)	38.31±7.67	38.58±7.61	37.89±7.74	<0.001
Screening center, Seoul	112,999 (52.24)	70,644 (53.72)	42,355 (49.94)	<0.001
Height (cm)	168.99±8.16	173.85±5.65	161.44±5.17	<0.001
Weight (kg)	68.81±12.47	75.4±10.13	58.59±8.12	<0.001
BMI (kg/m ²)	23.97±3.23	24.93±2.95	22.5±3.08	<0.001
ASM (kg)	21.45±4.58	24.59±2.73	16.59±1.78	<0.001
SMI ^a (kg/m ²)	7.43±1.02	8.12±0.59	6.36±0.49	<0.001
Muscle mass (kg)	47.92±9.15	54.17±5.54	38.22±3.34	<0.001
Fat mass (kg)	18.05±6.1	18.06±6.16	18.02±6.02	0.098
Current smoker	41,039 (18.97)	39,560 (30.08)	1,479 (1.74)	<0.001
Heavy drinking ^b	54,148 (25.03)	41,717 (31.72)	12,431 (14.66)	<0.001
Regular physical activity ^c	28,253 (13.06)	17,984 (13.68)	10,269 (12.11)	<0.001
SBP (mmHg)	109.68±12.43	114.29±11.17	102.53±10.8	<0.001
DBP (mmHg)	70.63±9.86	73.99±9.29	65.43±8.35	<0.001
Hypertension	23,499 (10.86)	19,805 (15.06)	3,694 (4.36)	<0.001
Diabetes mellitus	7,769 (3.59)	6,144 (4.67)	1,625 (1.92)	<0.001
Insulin (mg/dL)	5.9 (4.07-8.5)	6.24 (4.3-8.97)	5.44 (3.77-7.76)	<0.001
Glucose (mg/dL)	93 (88-99)	95 (90-101)	91 (86-96)	<0.001
Triglycerides (mg/dL)	95 (67-142)	115 (82-167)	72 (55-99)	<0.001
Total cholesterol (mg/dL)	194.04±33.9	198.93±34.25	186.45±31.89	<0.001
LDL-C (mg/dL)	123.06±31.94	130.11±31.44	112.14±25.95	<0.001
HDL-C (mg/dL)	58.08±15.28	53.18±13.07	65.68±15.35	<0.001
AST (IU/L)	20 (16-25)	22 (18-27)	17 (15-20)	<0.001
ALT (IU/L)	19 (13-29)	24 (17-36)	13 (10-17)	<0.001
Creatinine (mg/dL)	0.9 (0.7-1.0)	1 (0.9-1)	0.7 (0.6-0.7)	<0.001

Table 2. Basal characteristics of study subjects classified by CEA level.

	Men		P value	Women		P value
	CEA < 5	CEA ≥ 5		CEA < 5	CEA ≥ 5	
Number of subjects (n)	129,522	1,975		84,619	196	
Age (years)	38.51 (7.57)	43.18 (9.1)	<0.001	37.86 (7.72)	47.59 (11.59)	<0.001
Screening center, Seoul	69,513 (53.67)	1,131 (57.27)	0.001	42,237 (49.91)	118 (60.2)	0.004
Height (cm)	173.87 (5.65)	172.6 (5.77)	<0.001	161.45 (5.17)	159.26 (5.61)	<0.001
Weight (kg)	75.42 (10.12)	74.09 (10.24)	<0.001	58.6 (8.12)	58.28 (8.61)	0.607
BMI (kg/m ²)	24.93 (2.95)	24.84 (2.96)	0.2	22.5 (3.08)	23.02 (3.52)	0.018
ASM (kg)	24.6 (2.73)	24.21 (2.76)	<0.001	16.59 (1.78)	16.26 (1.78)	0.008
SMI ^a (kg/m ²)	8.12 (0.59)	8.1 (0.6)	0.406	6.36 (0.49)	6.4 (0.5)	0.24
Muscle mass (kg)	54.18 (5.54)	53.5 (5.61)	<0.001	38.22 (3.34)	37.91 (3.33)	0.205
Fat mass (kg)	18.07 (6.16)	17.5 (6.2)	<0.001	18.02 (6.01)	18.06 (6.92)	0.925
Current smoker	38,490 (29.72)	1,070 (54.18)	<0.001	1,453 (1.72)	26 (13.27)	<0.001
Heavy drinking ^b	40,934 (31.6)	783 (39.65)	<0.001	12,395 (14.65)	36 (18.37)	0.03
Regular physical activity ^c	17,650 (13.6)	334 (16.91)	<0.001	10,232 (12.09)	37 (18.88)	0.001
SBP (mmHg)	114.28 (11.16)	114.73 (12.16)	0.078	102.52 (10.79)	108.6 (14.08)	<0.001
DBP (mmHg)	73.97 (9.28)	75.23 (9.64)	<0.001	65.42 (8.35)	69.9 (9.69)	<0.001
Hypertension	19,391 (14.97)	414 (20.96)	<0.001	3,654 (4.32)	40 (20.41)	<0.001
Diabetes mellitus	5,859 (4.52)	285 (14.43)	<0.001	1,596 (1.89)	29 (14.8)	<0.001
Insulin (mg/dL)	6.24 (4.3-8.97)	5.81 (3.97-8.68)	<0.001	5.44 (3.77-7.76)	5.51 (3.44-7.72)	0.43
Glucose (mg/dL)	95 (90-101)	97 (91-105)	<0.001	91 (86-96)	93 (86-102)	<0.001
Triglycerides (mg/dL)	115 (82-167)	124 (87-185)	<0.001	72 (55-99)	84.5 (59-142)	<0.001
Total cholesterol (mg/dL)	198.83 (34.2)	205.52 (36.99)	<0.001	186.41 (31.85)	201.65 (43.1)	<0.001
LDL-C (mg/dL)	130.04 (31.38)	134.2 (34.57)	<0.001	112.11 (29.51)	124.32 (39.1)	<0.001
HDL-C (mg/dL)	53.17 (13.05)	53.29 (14.64)	0.689	65.68 (15.34)	66.06 (17.83)	0.729
AST (IU/L)	22 (18-27)	22 (19-28)	<0.001	17 (15-20)	20 (17-25)	<0.001
ALT (IU/L)	24 (17-36)	24 (18-36)	0.392	13 (10-17)	16 (12-22)	<0.001
Creatinine (mg/dL)	1 (0.9-1)	0.9 (0.9-1)	<0.001	0.7 (0.6-0.7)	0.7 (0.6-0.8)	<0.001

Values are mean±SD, numbers (percentage), or median (interquartile range).

^aSMI=ASM/height(m²).

^b≥20g/day in male and ≥10g/day in female.

^cVigorous exercise≥3times/week.

ASM, appendicular skeletal mass; CEA, carcinoembryonic antigen; BMI, body mass index; SMI, skeletal muscle mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; LDL, low density lipoprotein cholesterol; HDL, high density lipoprotein cholesterol; AST, aspartate aminotransferase; ALT, alanine aminotransferase.

Table 3. Hazard ratios (95% CIs) of low skeletal muscle incidence by CEA level.

	Men		Women		P for interaction
	CEA < 5	CEA ≥ 5	CEA < 5	CEA ≥ 5	
No. of Participants (%)	129,522 (98.5)	1,975 (1.5)	84,619 (99.77)	196 (0.23)	
Person-years (PY)	501899.47	7418.37	309810.63	642.45	
Incident Cases	2,338	63	6,055	21	
Incidence Density (cases per 10 ³ PY)	0.47 (0.45 - 0.49)	0.85 (0.66 - 1.09)	1.95 (1.91 - 2.00)	3.27 (2.13 - 5.01)	
Hazard Ratio					
Unadjusted model (95% CI)	Reference	1.83 (1.42 - 2.35)	Reference	1.70 (1.11 - 2.61)	0.766
Adjusted HR (95% CI) ^a	Reference	1.56 (1.21 - 2.01)	Reference	1.65 (1.08 - 2.55)	0.731
Adjusted HR in time-varying model (95% CI) ^b	Reference	1.65 (1.28 - 2.12)	Reference	1.69 (1.11 - 2.57)	0.869

^aAdjusted for age, glucose, heavy drinker, smoking status, LDL, ALT, serum creatinine, and regular physical activity.

^bAdjusted for glucose, heavy drinker, smoking status, LDL, ALT, serum creatinine, and regular physical activity.

Table 3

- In men, incidence density of LMM was 0.85 in high CEA group, and 0.47 in normal CEA group, which was higher in the high CEA group.
- In women, incidence density of LMM was 3.27 in high CEA group, and 1.95 in normal CEA group, which was higher in the high CEA group.
- After adjustments for possible confounding factors, adjusted HR of incident LMM in high CEA group were 1.56 (men, 95% CI: 1.21-2.01) and 1.65 (women, 95% CI: 1.08-2.55) compared to normal CEA group.
- After adjustments for time-varying confounding factors, adjusted HR were 1.65 (men, 95% CI: 1.28-2.12) and 1.69 (women, 95% CI: 1.11-2.57) compared to normal CEA group.

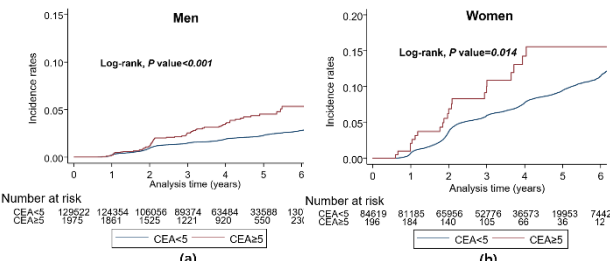


Figure 1

The 6-year cumulative incidence rates of LMM by CEA level in (a) men and (b) women were shown, revealing a significant difference (log-rank test; $P < 0.001$ in men and $P = 0.014$ in women).

Conclusion

- In this prospective cohort study, high CEA level was independently associated with incident LMM, suggesting CEA level as a possible predictor of decline in muscle mass among adults without cancer. Screening for CEA level in healthy adults without cancer can be important to prevent sarcopenia.