

Chapter 7

NUTRITIONAL STATUS ON DIALYSIS

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SECTION 7.1: SERUM ALBUMIN LEVELS ON DIALYSIS

The mean serum albumin level in HD patients in the year 2014 was 38.5 g/L. The percentage of patients with low serum albumin of <30g/L has remained the same but the percentage of patients with desirable serum albumin of ≥40 g/L had reduced gradually over 10 years since 2005, with the proportion showing a decreasing trend from 56 to 41% from the year 2005 to 2014 (Table 7.1.1). The cumulative distribution trends of serum albumin for HD patients from 2005 to 2014 supported this observation (Figure 7.1.1).

Table 7.1.1: Distribution of serum albumin, HD patients, 2005-2014

Year	Number of patients	Mean	SD	Median	LQ	UQ	% patients <30g/L	% patients 30-<35g/L	% patients 35-<40g/L	% patients ≥40g/L
2005	8705	40.0	5.2	40.3	37.5	42.8	3	9	33	56
2006	10927	39.8	5.4	40.3	37.3	42.8	3	10	33	54
2007	12315	39.7	5.3	40.0	37.0	42.5	3	10	35	52
2008	14551	39.4	5.1	40.0	37.0	42.3	3	10	36	50
2009	16948	39.4	5.1	40.0	37.0	42.3	3	11	35	51
2010	18757	38.9	4.9	39.3	36.3	41.8	4	13	40	44
2011	21360	38.8	4.9	39.3	36.5	41.5	4	12	41	43
2012	24531	38.8	5.0	39.3	36.3	41.5	4	13	41	43
2013	27818	38.6	4.9	39.0	36.0	41.5	4	13	42	41
2014	31287	38.5	4.9	39.0	36.0	41.5	4	15	41	41

Figure 7.1.1: Cumulative distribution of serum albumin, HD patients 2005-2014

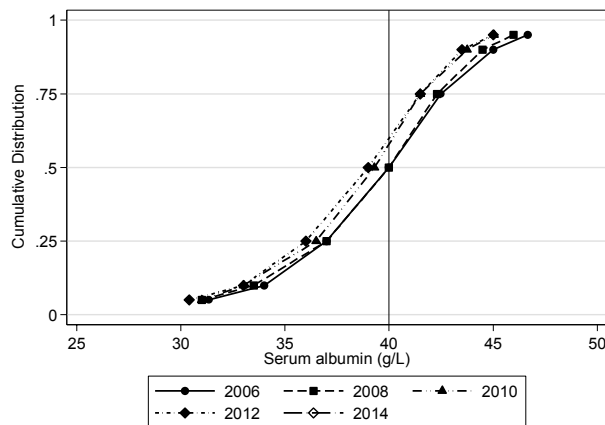
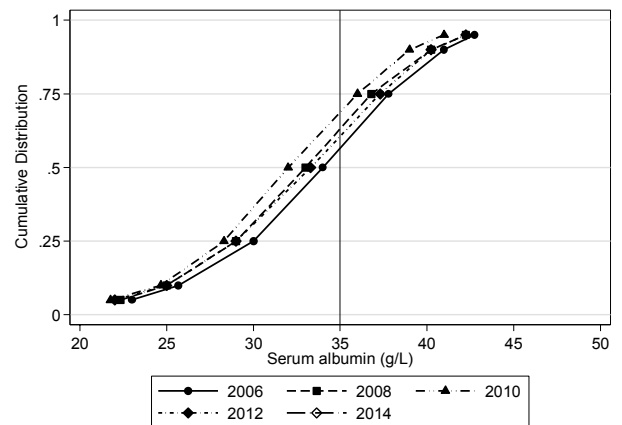


Figure 7.1.2: Cumulative distribution of serum albumin, PD patients 2005-2014



The same trend was observed in PD patients since 2005. The percentage of patients with unsatisfactory serum albumin (<30g/L) increased from 27% to 30% in 2014 while the percentage of patients with desirable serum albumin levels of ≥40g/L remained about 10-11%. Cumulative distribution trends of serum albumin for PD patients from 2005 to 2014 supported this observation (Figure 7.1.2).

Table 7.1.2: Distribution of serum albumin, PD patients, 2005 - 2014

Year	Number of patients	Mean	SD	Median	LQ	UQ	% patients <30g/L	% patients 30-<35g/L	% patients 35-<40g/L	% patients ≥40g/L
2005	1346	33.2	6.4	33.3	29.5	37.0	27	33	30	10
2006	1498	33.5	6.1	33.8	30.0	37.0	25	33	30	12
2007	1753	33.6	6.2	34.0	30.0	37.8	25	31	30	14
2008	2021	33.1	6.4	33.3	29.3	37.3	28	32	27	13
2009	2138	32.7	6.4	33.0	29.0	36.8	30	34	25	11
2010	2305	32.1	6.2	32.3	28.5	36.0	33	35	24	8
2011	2465	31.9	6.0	32.0	28.3	36.0	35	34	23	8
2012	2801	32.6	6.5	32.8	29.0	36.5	31	33	27	10
2013	3172	33.0	6.6	33.3	29.0	37.3	29	31	28	12
2014	3619	32.6	6.8	33.0	28.8	36.8	30	32	26	11

As in previous reports, there was a wide variation in serum albumin among the 642 HD centres in 2014 (Table 7.1.3). Half of the HD centres achieved 42% of their HD patients with albumin level ≥ 40 g/L. The median percentage of HD patients with albumin level ≥ 40 g/L had significantly deteriorated from 58% in 2005 to 42% in 2014 (Figure 7.1.3).

Table 7.1.3: Variation in proportion of patients with serum albumin ≥ 40 g/L among HD centres 2005-2014

Year	Number of centers	Min	5 th centile	LQ	Median	UQ	95 th centile	Max
2005	217	3	8	41	58	71	90	100
2006	274	0	6	36	55	73	89	100
2007	300	0	9.5	36	53	70	88.5	100
2008	346	0	6	33	50	67	84	100
2009	389	0	4	38	52	65	85	100
2010	430	0	4	26	44	60	80	100
2011	488	0	6	27	44	58	76	100
2012	546	0	3	26	42.5	58	76	96
2013	600	0	6	24	41	57.5	72	100
2014	642	0	3	23	42	57	75	91

Figure 7.1.3: Variation in proportion of patients with serum albumin ≥ 40 g/L, HD centres 2014

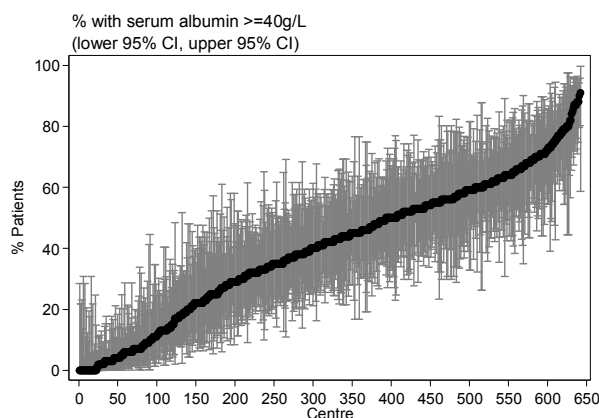
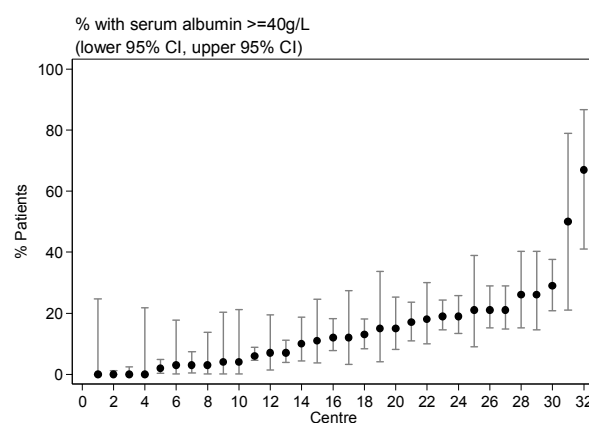


Figure 7.1.4: Variation in proportion of patients with serum albumin ≥ 40 g/L, PD centres 2014



A wide variation in serum albumin among the 32 PD centres in 2014 is also evident (Figure 7.1.4). Half of the PD centres achieved 12 % of their PD patients with albumin level ≥ 40 g/L (Table 7.1.4).

Table 7.1.4: Variation in proportion of patients with serum albumin ≥ 40 g/L among PD centres 2005-2014

Year	Number of centers	Min	5 th centile	LQ	Median	UQ	95 th centile	Max
2005	18	0	0	6	13	23	29	29
2006	24	0	0	5	13	21	33	76
2007	23	0	0	4	15	23	35	64
2008	23	0	0	2	15	25	43	56
2009	23	0	0	5	14	24	36	37
2010	25	0	0	2	9	17	29	32
2011	26	0	0	1	5.5	21	29	38
2012	28	0	0	3	10	20.5	33	37
2013	28	0	0	2	8	23.5	31	40
2014	32	0	0	3.5	12	20	50	67

SECTION 7.2: BODY MASS INDEX (BMI) ON DIALYSIS

The mean BMI for HD patients in 2014 was 24.3 kg/m². An increasing trend of BMI was observed for HD patients, with the percentage of HD patients with BMI ≥ 25 kg/m² increasing from 29% in 2005 to 39% in 2014. As expected, the percentage of patients with BMI <18.5 reduced from 14% in 2004 to 10% in 2014 (Table 7.2.1)

Table 7.2.1: Distribution of BMI, HD patients, 2005 - 2014

Year	Number of patients	Mean	SD	Median	LQ	UQ	% patients <18.5	% patients 18.5-25	% patients ≥25
2005	7827	23.1	5.6	22.5	19.8	25.6	14	57	29
2006	9783	23.1	5.2	22.6	19.9	25.7	14	56	29
2007	10507	23.2	5.4	22.7	19.9	25.8	14	56	30
2008	12229	23.3	5.1	22.8	20.1	26.0	14	55	31
2009	13747	23.5	5.2	23.0	20.1	26.2	13	54	33
2010	14720	23.7	5.3	23.2	20.3	26.4	12	53	35
2011	16479	23.8	5.7	23.2	20.4	26.5	12	53	35
2012	18355	24.0	5.4	23.4	20.5	26.7	11	52	37
2013	20325	24.1	5.6	23.5	20.6	26.9	11	51	38
2014	22046	24.3	5.9	23.7	20.7	27.0	10	51	39

Figure 7.2.1: Cumulative distribution of BMI, HD patients 2005- 2014

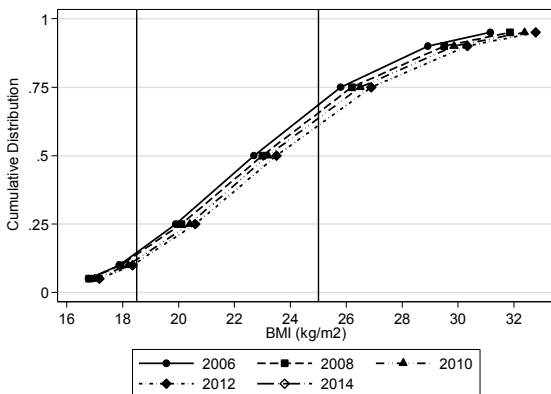
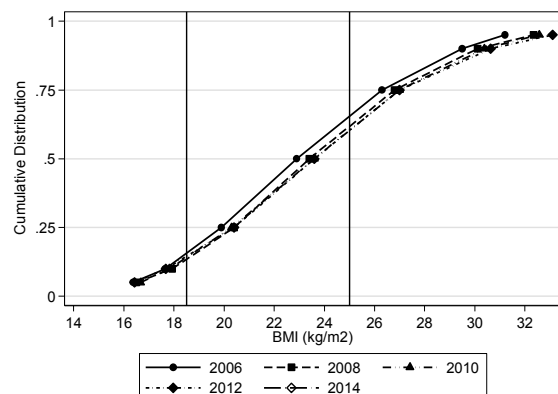


Figure 7.2.2: Cumulative distribution of BMI, PD patients 2005-2014



The mean BMI for PD patients in 2014 was 24.2 kg/m². The percentage of PD patients with BMI ≥ 25 kg/m² increased from 30% in 2005 to 39% in 2014, whilst the percentage of patients with BMI <18.5 kg/m² reduced significantly from 20% in 2005 to 12% in 2014 (Table 7.2.2). As in previous years, the shifting of the cumulative distribution curve for 2014 was to the right (Figure 7.2.2).

Table 7.2.2: Distribution of BMI, PD patients 2005 - 2014

Year	Number of patients	Mean	SD	Median	LQ	UQ	% patients <18.5	% patients 18.5-25	% patients ≥25
2005	1223	23.0	7.2	22.5	19.3	25.8	20	50	30
2006	1420	23.3	8.3	22.6	19.6	26.1	16	50	33
2007	1617	23.4	5.9	22.9	19.9	26.3	15	51	34
2008	1875	23.7	5.9	23.2	20.2	26.6	14	50	36
2009	1947	24.0	7.1	23.4	20.4	26.8	13	50	37
2010	2052	24.4	8.8	23.5	20.5	27.1	13	49	39
2011	2179	24.1	7.8	23.6	20.3	27.0	13	49	38
2012	2213	24.1	6.8	23.5	20.5	26.9	13	49	38
2013	2025	24.2	7.2	23.6	20.4	27.0	14	47	39
2014	2428	24.2	6.5	23.6	20.7	26.9	12	49	39

Half of the HD centers achieved 90% of their patients with BMI ≥ 18.5 kg/m² in 2014 (Table 7.2.3)

Table 7.2.3: Variation in proportion of patients with BMI ≥ 18.5 among HD centres 2005-2014

Year	Number of centers	Min	5 th centile	LQ	Median	UQ	95 th centile	Max
2005	208	60	69	81	87	92	100	100
2006	263	52	70	81	86	92	100	100
2007	284	56	69	82	87	92	100	100
2008	326	60	69	82	88	92	100	100
2009	351	61	72	81	87	93	100	100
2010	383	33	73	84	89	94	100	100
2011	427	46	75	84	90	93	100	100
2012	472	60	76	85.5	90	94	100	100
2013	534	54	76	86	91	94	100	100
2014	571	50	77	86	90	95	100	100

Figure 7.2.3: Variation in proportion of patients with BMI ≥ 18.5 among HD centres 2014

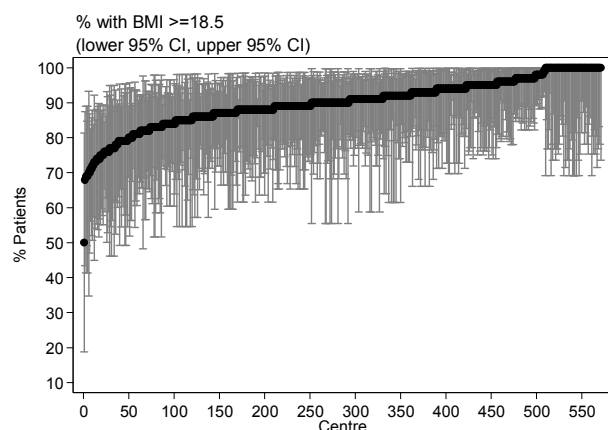
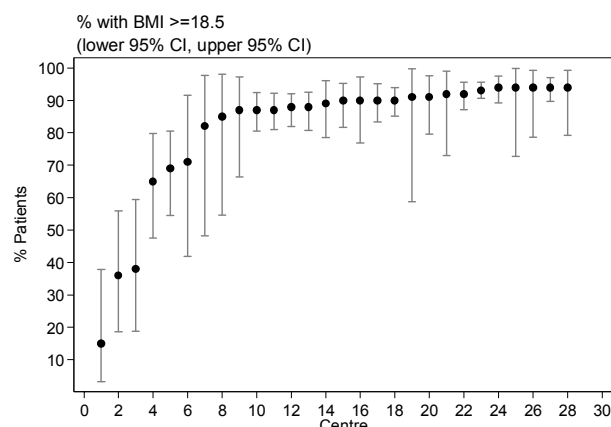


Figure 7.2.4: Variation in proportion of patients with BMI ≥ 18.5 among PD centres 2014



Half of the PD centers achieved 89.5% of their patients with BMI ≥ 18.5 kg/m² in 2014 (Table 7.2.4)

Table 7.2.4: Variation in proportion of patients with BMI ≥ 18.5 among PD centres 2005-2014

Year	Number of centers	Min	5 th centile	LQ	Median	UQ	95 th centile	Max
2005	17	21	21	71	84	88	91	91
2006	23	22	28	74	84	91	93	96
2007	22	20	23	76	87.5	91	97	100
2008	22	24	33	77	88	91	95	100
2009	21	29	41	80	89	93	95	97
2010	23	37	44	76	89	93	98	98
2011	25	33	35	80	88	93	96	98
2012	25	32	33	79	86	92	97	100
2013	25	18	35	70	90	93	97	100
2014	28	15	36	83.5	89.5	92	94	94

There was a wide variation in the nutritional status of patients in 560 HD centres in 2014 (Table 7.2.5). Half of the centres achieved the combined nutritional status targets (serum albumin ≥ 40 g/dL and BMI ≥ 18.5 kg/m²) in only 39% of their patients.

Table 7.2.5: Variation in proportion of patients with BMI ≥ 18.5 and serum albumin ≥ 40 g/dL among HD centres 2005-2014

Year	Number of centers	Min	5 th centile	LQ	Median	UQ	95 th centile	Max
2005	195	0	9	35	50	61	82	92
2006	251	0	6	33	48	63	80	94
2007	277	0	6	34	48	62	76	93
2008	314	0	4	31	45.5	60	76	88
2009	341	0	4	33	47	62	76	94
2010	378	0	3	23	41	57	73	83
2011	417	0	2	25	40	54	73	100
2012	458	0	1	23	40	56	73	90
2013	519	0	4	23	38	52	70	95
2014	560	0	2.5	20	39	55	72	88

Figure 7.2.5: Variation in proportion of patients with BMI ≥ 18.5 and serum albumin ≥ 40 g/dL among HD centres 2014

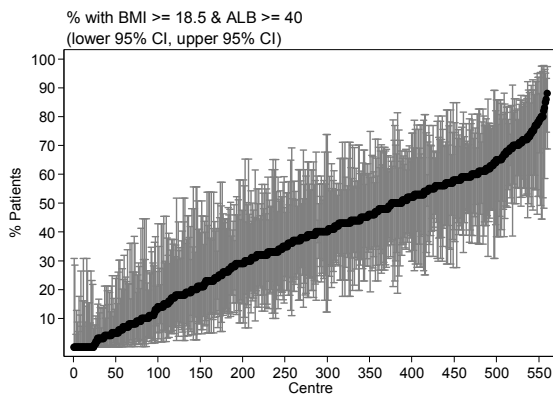


Figure 7.2.6: Variation in proportion of patients with BMI ≥ 18.5 and serum albumin ≥ 40 g/dL among PD centres 2014

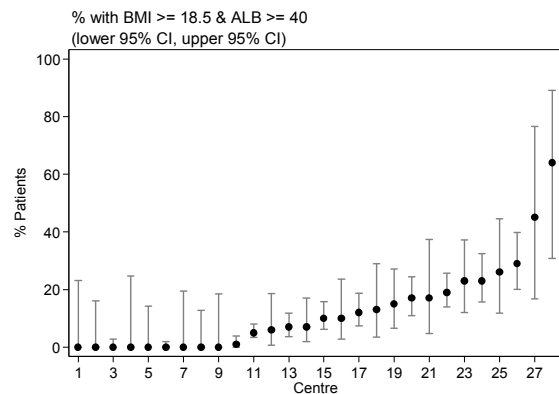


Table 7.2.6 indicates a wide variation in the nutritional status of patients in 28 PD centers as assessed by BMI ≥ 18.5 kg/m² and serum albumin ≥ 40 g/dL. Half of these centres achieved the combined nutritional status targets in only 8.5% of their patients. As in 2014, none of the 28 PD centres had 50% of their patients achieved the combined nutritional status targets in 2014 (Figure 7.2.6).

Table 7.2.6: Variation in proportion of patients with BMI ≥ 18.5 and serum albumin ≥ 40 g/dL among PD centres 2005-2014

Year	Number of centers	Min	5 th centile	LQ	Median	UQ	95 th centile	Max
2005	17	0	0	4	10	18	29	29
2006	23	0	0	4	11	19	21	55
2007	22	0	1	8	12	19	36	60
2008	22	0	0	3	9.5	19	26	48
2009	21	0	0	4	10	19	28	35
2010	23	0	0	1	8	13	24	25
2011	25	0	0	0	6	17	26	35
2012	25	0	0	2	7	14	26	38
2013	25	0	0	1	8	22	29	38
2014	28	0	0	0	8.5	18	45	64

SECTION 7.3: NUTRITIONAL PARAMETERS

Comparing HD with PD patients in 2014, we found out that HD patients were older and achieved better serum albumin compared to PD patients. Hemoglobin levels in HD patients were statistically higher but clinically not significant in comparison to PD patients. On the other hand, serum total cholesterol and creatinine were higher in PD patients. (Table 7.3.1)

Table 7.3.1: Nutritional parameters between HD and PD patients, 2014

	HD		PD		P-Value
	n= 32437		n= 3727		
	Mean	SD	Mean	SD	
Age	56.10	13.60	50.87	17.34	<0.0001 ^b
Albumin (g/dL)	38.46	4.93	32.61	6.76	<0.0001 ^b
BMI	24.29	5.87	24.17	6.50	0.5387 ^b
Total Cholesterol (mmol/L)	4.43	1.05	4.96	1.31	<0.0001 ^b
Sr Creatinine ((μmol/L)	812.45	238.68	850.97	314.51	<0.0001 ^b
Hemoglobin	10.38	1.58	10.30	1.56	0.0003 ^b

b Mann Whitney test*

In the HD population, the patients with diabetes were younger with lower BMI. They also had higher serum creatinine, albumin and total cholesterol compared to the non- diabetic patients. Hemoglobin levels were statistically higher but clinically not significantly in diabetic HD patients. (Table 7.3.2(a))

Table 7.3.2(a): Nutritional parameters between diabetic and non - diabetic HD patients, 2014

	Diabetes		Non-Diabetes		P-Value
	n= 15171		n= 17266		
	Mean	SD	Mean	SD	
Age	52.77	14.93	59.89	10.72	<0.0001 ^b
Albumin (g/dL)	38.92	4.93	37.94	4.88	<0.0001 ^b
BMI	23.45	5.67	25.24	5.94	<0.0001 ^b
Total Cholesterol (mmol/L)	4.47	1.02	4.39	1.09	<0.0001 ^b
Sr Creatinine ((μmol/L)	863.77	248.83	753.63	211.72	<0.0001 ^b
Hemoglobin	10.42	1.64	10.33	1.51	<0.0001 ^b

b Mann Whitney test*

Similar to the HD population, PD patients with diabetes were younger with lower BMI and better serum albumin, higher serum creatinine and total cholesterol levels compared to non- diabetic PD patients. (Table 7.3.2(b))

Table 7.3.2(b): Nutritional parameters between diabetic and non-diabetic PD patients, 2014

	Diabetes		Non-Diabetes		P-Value
	n= 1050		n= 2677		
	Mean	SD	Mean	SD	
Age	47.75	18.28	58.81	11.27	<0.0001 ^b
Albumin (g/dL)	33.14	6.66	31.23	6.83	<0.0001 ^b
BMI	23.52	5.78	25.79	7.78	<0.0001 ^b
Total Cholesterol (mmol/L)	5.02	1.29	4.83	1.35	<0.0001 ^b
Sr Creatinine ((μmol/L)	889.31	321.91	752.71	271.13	<0.0001 ^b
Hemoglobin	10.27	1.59	10.37	1.50	0.0853 ^b

b Mann Whitney test*

Similar to previous years findings , we noted that in HD patients, the longer they were on treatment, the higher their serum albumin and lower their BMI (Table 7.3.3a). Similar findings were noted in PD patients. The longer they were on PD treatment, the higher their serum albumin and lower their BMI (Table 7.3.3b).

Table 7.3.3(a): Distribution of serum albumin and BMI by duration of dialysis among HD patients, 2005-2014

Years	<1		1-<5		5-<10		≥10		P-Value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Albumin (g/dL)	35.88	5.66	38.68	3.84	39.86	3.19	40.25	2.99	0.0001 ^d
BMI	24.54	6.59	24.70	5.79	24.17	5.46	22.63	4.50	0.0001 ^d

d Kruskal Wallis rank test*

Table 7.3.3(b): Distribution of serum albumin and BMI by duration of dialysis among PD patients, 2005-2014

Years	<1		1-<5		5-<10		≥10		P-Value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Albumin (g/dL)	32.18	7.04	33.29	5.59	34.29	4.38	35.10	3.68	0.0001 ^d
BMI	24.56	6.97	24.53	8.57	23.30	4.22	22.07	3.70	0.0001 ^d

d Kruskal Wallis rank test*