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Research article

The conditions of 26 patients treated by peritoneal dialysis correlated with their BMI and age.

Giancarlo Ruggieri

Past affiliation : Center of Nephrology, Department of Nephrology and Urology, San Giacomo and ONRM Hospitals, Roma, Italy

E-mail: giancarlo.ruggieri@mclink.net

Abstract – The data concerning the biologic conditions as well as the scheduled treatments of 26 patients undergoing chronic peritoneal dialysis underwent to a study having the aim to define the correlations of these data with their years of age and with the their body structure, here represented by the Body Mass Index (BMI) size. The data to be correlated have been previously indexed on BMI and on age, to emphasize the eventual existing relationships. High significant correlations of the indexed variables were ascertained with the years of age while the corresponding correlations of BMI attained statistic lower results, a difference found even according to different methods of comparison. It was also observed that the correlations based on BMI significantly improved when the BMI values was based on a correct relationship weight-height, even not attaining the degree of results based on age, that is to say that BMI could be used as indexation tool only when inside its limits of normality. It was concluded that the cause of the difference of the results was due to the intrinsic characteristics of BMI and of age, whose very better results are based on the direct genetic relationship of the years of age with the modifications in time of the somatic variables, with possible accidental exceptions due to the worsening of the somatic conditions induced by diseases or on the contrary due to prolonged good general conditions based on a body maintenance better than that waited for the chronological age.

Key words : BMI, age, biologic conditions, peritoneal dialysis

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Premise – It is well known that the years of age and the body mass size variously may influence in time the general conditions of the persons, this particularly in subjects affected by diseases, according to their different specific diseases. In the present work, the influence of the age and of the body mass structure on the biologic conditions were analyzed in a population of 26 subjects undergoing chronic peritoneal dialysis. The variable arbitrary assumed to represent the body mass structure was the body mass index (BMI).

Materials and method.

Materials - The studied population was represented by 26 patients undergoing chronic peritoneal dialysis, of whom 12 males and 14 females. The male patients had 7,17± 2,62 years of dialytic treatment while the length of the previous treatment was not available in the females database. The years of age of male patients was 52,17±16,15 and of female patients was 51,6±13,36 : respectively BMI was 26,03±4,93 and 24,5±3,94 ; the creatinine clearance liters/day (CtCl/liters/day) was 94,34±31,62 for males and 80,42±20,05 for females. The variables to be correlated with the BMI and with the years of age were selected within those available for males and females, as it follows : the liters of the used solutions according to the glucose concentrations, 1,36%, 2,27% and 3,86%, the liters of icodextrine solution, the amount of residual diuresis, creatininemia, azotemia, protidemia, albuminemia, cholesterolemia, triglyceridemia, hemoglobinemia, hematocrit, creatinine clearance, and lymphocytemia.

Method - The existence of a significant or not significant degree of relationships between age and BMI, and the variables mentioned above was ascertained by stating the statistical significance of their correlations, that was calculated using the statistic software MINITAB 18, by Minitab , PE, USA, using the tool of "correlation" of Basic Statistics, by which the Pearson's correlation values and their statistic significance by the probability value (p) were stated. The correlations have been studied on the data of males and females, that was indexed on BMI when correlated with BMI and on the years of age when correlated with age. This method had the aim to modulate the size of the selected variables according to the corresponding modulations of size of BMI or of age. The basal data of males and females were compared each other by T Test, that not pointed out a significant difference between the respective data. It allowed to group the data of male and females in a common bulk that underwent to the same procedure of indexation on BMI and on age. The following Tab. I shows the descriptive statistics of the male and female basal data, while the correlated Tab. II shows the statistics comparison of their respective data. The comparison of data between males and females points out the absence of significant differences, with exception for the variable "Lymphocytemia", that resulted very hardly greater than the limits of significance, p = 0,05.

Table I and Table II – Descriptive statistics of data concerning males and females and their comparison

Tab. I - Basal data of males and females

Selected variables	males	females
	mean±SD	mean±SD
age	52,17±16,15	51,6±13,36
BMI	26,03±4,93	24,5±3,94
Dialysis years	7,17±2,62	***
dialysis solution 1,36 lt	11,75±8,74	6,57±6,38
dialysis solution 2,27 lt	2±3,4	2,43±3,25
dialysis solution 3,86 lt	0,42±1,44	1,36±2,98
Icodextrine	0,5±0,9	0,29±0,73
residual diuresis	732,1±707,8	557,1±584,4
creatininemia	10,99±2,75	9,36±2,15
azotemia	79,68±19,26	74,26±20,11
protidemia	7,05±0,76	6,18±1,87
albuminemia	4,09±0,45	3,46±1,1
cholesterolemia	194,3±51,7	234,6±97,9
thryglicerydemia	172,7±86,9	170,14±103,1
Hemoglobinemia	9,82±1,69	8,87±2,9
Hematocrit	29,34±5,14	24,25±11
Lymphocytemia	2158±1036	1349,3±936,1
Dialized Volumw	14708±7371	11514±5529
CtCl liters /24 h	94,34±31,6	80,42±20
CtCl week	660,4±221,3	562,9±140,3

Note - Females data lack the variable " dialysis years "

Tab. II - Comparison of selected data, males versus females

Selected variables	Males	Females	
	mean±SD	mean±SD	Test T
age	52,17±16,15	51,64±13,36	T Value = 0,09, p = 0,29, DF = 21
BMI	26±4,93	24,5±3,94	T Value = 0,85, p = 0,406, DF = 21
dialysis solution 1,36 lt	11,75±8,74	6,57±6,38	T Value = 1,70, p = 0,105, DF = 19
dialysis solution 2,27 lt	2±3,4	2,43±3,25	T Value = -0,33, p = 0,746, DF = 23
dialysis solution 3,86 lt	0,42±1,44	1,36±2,98	T Value = -1,05, p = 0,309, DF = 19
Icodextrine	0,5±0,9	0,29±0,73	T Value = 0,65, p = 0,525, DF = 21
residual diuresis	732±707,8	557,14±584,4	T Value = 0,68, p = 0,504, DF = 21
creatininemia	11±2,75	9,36±2,15	T Value = 1,67, p = 0,110, DF = 20
azotemia	79,7±19,3	74,26±20,11	T Value = 0,70, p = 0,489, DF = 23
protidemia	7±0,76	6,18±1,87	T Value = 1,50, p = 0,151, DF = 17
albuminemia	4,1±0,45	3,46±1,11	T Value = 1,98, p = 0,065, DF = 17
cholesterolemia	194,3±51,7	234,6±97,9	T Value = -1,34, P = 0,196, DF = 20
thryglicerydemia	172,7±86,9	170,14±103,1	T Value = 0,07, p = 0,946, DF = 23
Hemoglobinemia	9,83±1,69	8,87±2,91	T Value = 1,05, p = 0,308, DF = 21
Hematocrit	29,34±5,14	24,25±11	T Value = 1,55, p = 0,139, DF = 19
Lymphocytemia	2158±1036	1349±936	T Value = 2,37, P = 0,05, DF = 22
Dialized Volumw	14708±7371	11514±5529	T Value = 1,23, p = 0,232, DF = 20
CtCl liters /24 h	94,34±31,6	80,42±20	T Value = 1,32, p = 0,204, DF = 18
CtCl week	25,97±9,1	23,42±6,64	T Value = 0,80, p = 0,431, DF = 19

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The following Tab.III and Tab. IV concern the correlations of BMI and of age with the selected variable, respectively for males and females.

Table III and Table IV - Correlations of BMI and of age versus selected variables indexed on BMI and on age in males and in females

Tab. III - Males - Correlations of BMI and of age versus selected variables indexed on BMI and on age

	Correlations based on BMI		Correlations based on age	
variables	Pearson's correlation	p	Pearson's correlation	p
dialysis years	-0,233	0,466	-0,56	0,058
PD solutions 1,36 %	-0,75	0,005	-0,755	0,004
PD solutions 2,27 %	0,195	0,543	0,375	0,23
PD solutions 3,86 %	-0,098	0,761	-0,315	0,318
PD solutions Icodextrine	0,442	0,15	0,246	0,441
residual diuresis	-0,177	0,625	-0,453	0,139
creatininemia	-0,487	0,108	-0,85	0,000
azotemia	-0,274	0,388	-0,782	0,003
protidemia	-0,804	0,002	0,917	0,000
albuminemia	-0,878	0,000	-0,967	0,000
cholesterolemia	-0,446	0,146	-0,747	0,005
thryglicerydemia	0,53	0,076	-0,239	0,455
hemoglobinemia	-0,722	0,008	-0,863	0,000
hematocrit	-0,747	0,005	-0,879	0,000
lymphocytes	-0,604	0,038	-0,637	0,026
dialyzed volume	-0,687	0,014	-0,806	0,002
CtCl liters/24h	-0,379	0,224	-0,591	0,043
CtCl/week	-0,416	0,179	-0,591	0,043

Tab. IV - Females - Correlations of BMI and of age versus variables indexed on BMI and on age

	Correlations based on BMI		Correlations based on age	
variables	Pearson's correlation	p	Pearson's correlation	p
PD solutions 1,36 %	-0,685	0,007	-0,753	0,002
PD solutions 2,27 %	0,581	0,029	0,242	0,404
PD solutions 3,86 %	-0,057	0,848	-0,099	0,736
PD solutions Icodextrine	0,381	0,179	0,292	0,312
residual diuresis	-0,079	0,788	-0,617	0,019
creatininemia	-0,455	0,102	-0,838	0,000
azotemia	-0,332	0,247	-0,762	0,002
protidemia	-0,834	0,000	-0,934	0,000
albuminemia	-0,673	0,008	-0,898	0,000
cholesterolemia	-0,102	0,728	-0,734	0,003
thryglicerydemia	-0,097	0,742	-0,103	0,726
hemoglobinemia	-0,815	0,000	-0,856	0,000
hematocrit	-0,804	0,001	-0,007	0,981
lymphocytes	-0,31	0,281	-0,809	0,000
dialyzed volume	-0,517	0,058	-0,776	0,001
CtCl liters/24h	-0,464	0,095	-0,692	0,006
CtCl/week	-0,464	0,095	0,845	0,000

The variable " dialysis years" is not available in females data

From the tables above, the correlations based on BMI attain a percentage of 35,29 % of significant correlations on all correlations , versus the percentage of 70,59 % of significant results based on age. Taking into account that the values of the significant probability (p values) quite differed each other, it was assumed to emphasize the attained values of probability. This aim was realized by stating scores for each p value, on the base of the following arbitrary scale : p > 0,05 = 0 ; <0,05;>0,045 = 2 ; <0,009;≤ 0,001 = 3 ; >0,0001;<0,0009 = 5 ; p = 0,000 = 7. Based of these criteria, the correlations in Tab.III (males) resulted in a total of scores of 1,22±1,9 for correlations with BMI and of 3,47±2,94 for correlations with age, this difference resulting to be statistically significant, T Test value 2,24, p = 0,032, DF = 32. For females, in Tab. IV the total scores resulted in 1,47±2,4 for BMI correlations and in 3,35±3,04 for age correlations. This difference also resulted statistically significant at T Test : T Value = -2,06,p = 0,048, DF = 32. Because the not significant difference between the data of males and females resulted in Tab. II, the data of males and females was grouped in a common bulk, Tab. V.

Tab. V - Grouped Males and Females - Correlations of BMI and of age versus variables indexed on BMI and on age

	Correlations based on BMI		Correlations based on age	
variables	Pearson's correlation	p	Pearson's correlation	p
PD solutions 1,36 %	-0,633	0,001	-0,726	0,000
PD solutions 2,27 %	0,354	0,076	0,3	0,136
PD solutions 3,86 %	-0,094	0,648	-0,185	0,367
PD solutions Icodextrine	0,426	0,03	0,265	0,191
Residual diuresis	-0,098	0,635	-0,525	0,006
Creatininemia	-0,418	0,034	-0,817	0,000
Azotemia	-0,29	0,151	-0,74	0,000
Protidemia	-0,8	0,000	-0,921	0,000
Albuminemia	-0,781	0,000	-0,93	0,000
Cholesterolemia	-0,299	0,137	-0,676	0,000
Thriglycerydemia	0,106	0,608	-0,168	0,412
Hemoglobinemia	-0,799	0,000	-0,871	0,000
Hematocrit	-0,773	0,000	-0,866	0,000
Lymphocytes	-0,459	0,018	-0,643	0,000
Dialized volume	-0,562	0,003	-0,774	0,000
CtCl liters/24h	-0,373	0,061	-0,594	0,001
CtCl/week	-0,373	0,061	-0,594	0,001

The correlations based on BMI had significant results of 52,94 % of all correlations while those with age had significant results of 76,47 %. The scores of this grouping was 2,35±2,87 for the correlations with BMI and of 4,65±3,06 for the correlations with age, and this difference resulted to be significant at T test : T Test value = -2,26, p = 0,031, DF = 31. On base of the overall attained results, the age shown a constant better correlation with the considered variables. This could be due to a difference between the intrinsic characteristics of BMI and of age, inducing different degree of relationships between the indexing variable and the indexed variables. The different profiles of BMI and of age can be visually appreciated by the following graphs

Figure A

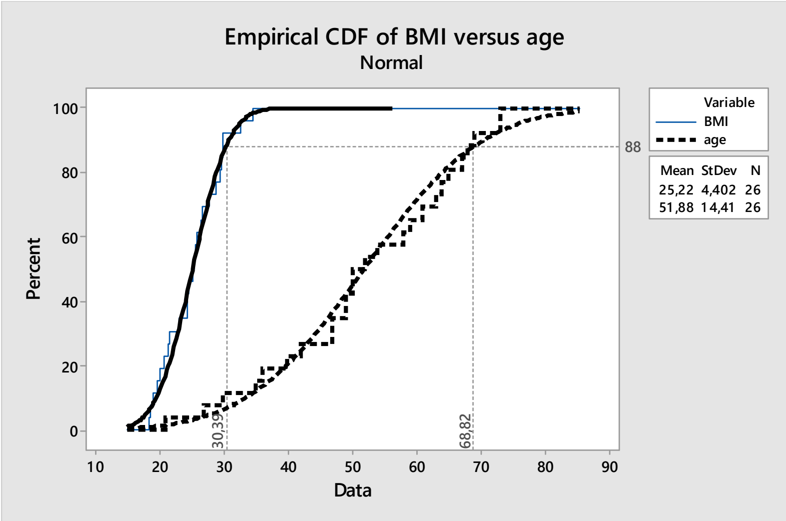
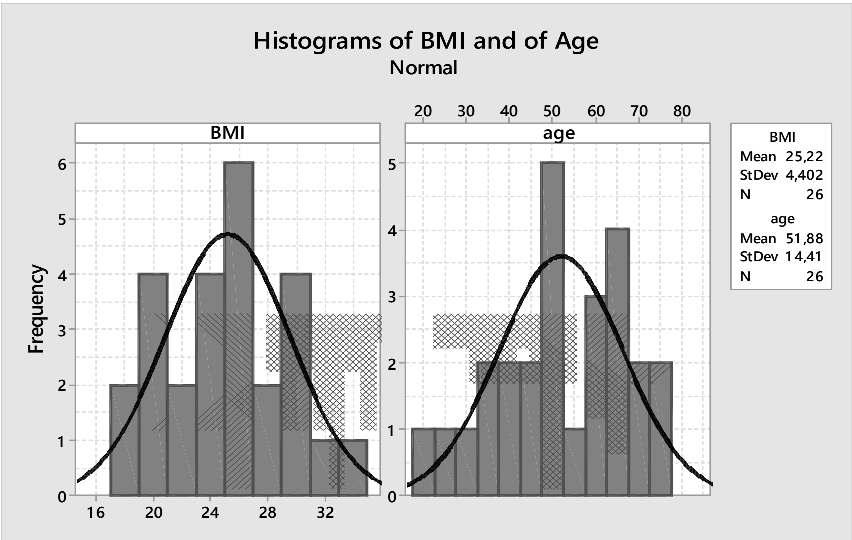


Figure B



It is evident the high difference between the two sloped lines in Empirical CDF, a basically vertical curve for BMI and a shaped bend for age, while in the following histograms the two curved lines fitting the distributions show differerent bell-shaped lines, with a more thight and high distribution for BMI. These differences may better explain the found difference between the correlations of BMI with the variables indexed on BMI and the correlations of age with the variables indexed on age. The relationships of data differently indexed (on BMI or on age) was further evaluated by a different graphic method, the scatterplot graphic, that shows the fitting of the regressions between BMI and age with the considered variables, using for this MINITAB 18. Because the lack of the usual statistic results data of the regressions (R and R^2), the interpretation of the scatterplots can be based only by observing the degree of the slope of the fitting line and the corresponding distribution of data around the fitting line. The scatterplot graphic offers a very different point of view to evaluate the relationships between the indexing variables (BMI, age) and the indexed variables. Its observation let to see the best results of regressions in the scatterplot concerning age versus all the considered variables with the only exception of the variable " hemoglobinemia" , attaining a very better performance than in the regression based on age.

Figure C

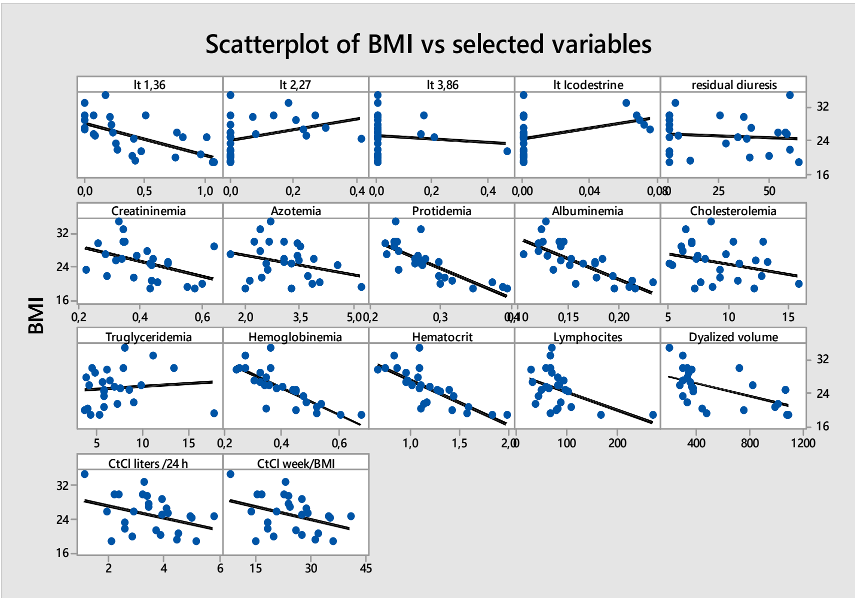
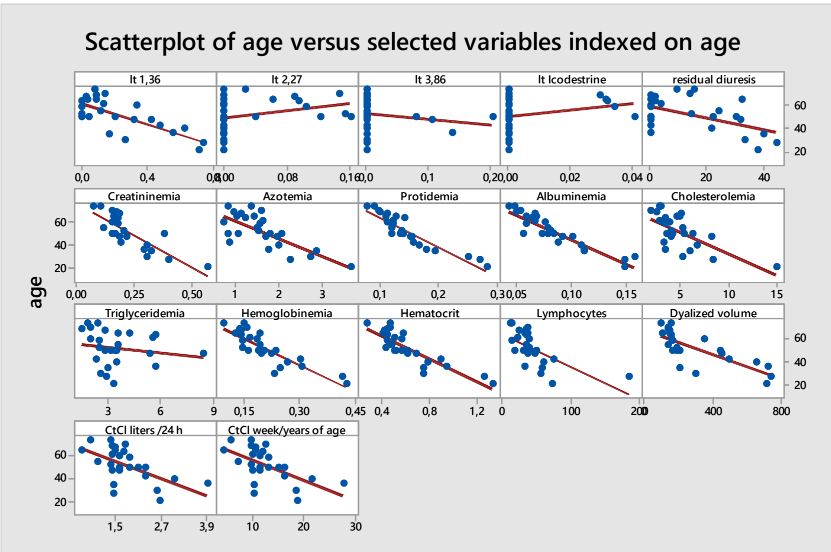


Figure D



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The scatterplots seem to confirm the results shown before, numerically measured by the very different sizes of the scores. It was analyzed also the coefficient of variation of the indexed males + females data according to the indexations by BMI and by age, because a different coefficient of variation could point out a different distribution of data between the two indexations : no differences were shown between the coefficients of variation : indexing on BMI, coefficient of variation = 0,798±0,647, indexing on age , coefficient of variation = 0,691±0,725, Comparison by T test : T Test Value = 0,47, p = 0,643, DF = 33. This particular high size of the coefficients of variation is due to two variables indexed on BMI and on age having coefficient of variation greater than 2,1.

A further analysis was performed on the correlations shown in Table V. It based on the separation in two groups of the data of the table, the first group including the values greater than the means of BMI and of age, and in the second group the lower values. This analysis had the aim to verify if the respective correlations were the same in the subjects having a BMI and an age greater or lower the means of the two indexing variables. The results are shown in the following Tables VI and VII.

Tab.VI - Results and scores of correlations of BMI versus variables indexed on BMI according to Pearson's correlation

	BMI greater than its mean			BMI lower than its mean		
variables	Pearson's	p	scores	Pearson's	p	scores
It 1,36 %	-0,206	0,501	0	-0,368	0,216	0
Lt 2,27 %	-0,011	0,972	0	0,525	0,065	0
It 3,86 %	-0,159	0,605	0	-0,51	0,075	0
Lt Icodextrine	0,078	0,801	0	0		0
Residual diuresis	-0,19	0,535	0	-0,558	0,047	2
Creatininemia	-0,111	0,718	0	-0,34	0,256	0
Azotemia	-0,323	0,281	0	-0,086	0,779	0
Protidemia	-0,345	0,248	0	-0,807	0,001	3
Albuminemia	-0,337	0,26	0	-0,622	0,023	2
Cholesterolemia	-0,132	0,668	0	-0,18	0,556	0
Triglyceridemia	0,359	0,229	0	-0,043	0,89	0
Hemoglobinemia	-0,32	0,386	0	-0,598	0,031	2
Hematocrit	-0,318	0,29	0	-0,612	0,026	2
Lymphocytes	-0,102	0,741	0	-0,523	0,067	0
Dialyzed volume	-0,311	0,3	0	-0,235	0,441	0
CtCl liters/24 h	-0,504	0,079	0	0,35	0,241	0
Mean of scores			0			0,69
SD of scores						1,078
The statistic evaluation of the differences of the scores unavailable						

Tab.VII - Results and scores of correlations of age versus variables indexed on age according to Pearson's correlation

	age greater than its mean			age lower than its mean		
variables	Pearson's	p	scores	Pearson's	p	scores
It 1,36 %	0,009	0,978	0	-0,705	0,007	3
Lt 2,27 %	-0,215	0,48	0	0,486	0,092	0
It 3,86 %	0		0	0,336	0,262	0
Lt Icodextrine	-0,051	0,867	0	0,271	0,37	0
Residual diuresis	-0,061	0,844	0	-0,558	0,047	2
Creatininemia	-0,488	0,091	0	-0,813	0,001	3
Azotemia	-0,341	0,254	0	-0,763	0,002	3
Protidemia	-0,767	0,002	3	-0,967	0,000	7
Albuminemia	-0,874	0	0	-0,925	0,000	7
Cholesterolemia	-0,455	0,118	0	-0,62	0,024	2
Triglyceridemia	-0,252	0,406	0	0,233	0,444	0
Hemoglobinemia	-0,47	0,105	0	-0,838	0,000	7
Hematocrit	-0,334	0,265	0	-0,885	0,000	7
Lymphocytes	-0,449	0,124	0	-0,594	0,032	2
Dialyzed volume	-0,414	0,16	0	-0,577	0,039	2
CtCl liters/24 h	-0,158	0,606	0	-0,283	0,349	0
Mean of scores			0,188			2,81
SD of scores			0,75			2,78
T test of the difference of the scores : T Value = -3,69 , p = 0,002, DF = 17						

Note : the comparison of the scores concerning BMI lower than its mean with those of age lower than its mean resulted to be significant at T test : T test, T Value = -2,88, p = 0,010, DF = 10

From the Tables VI and VII above two relevant results can be observed : a) only the values corresponding to the lower BMI and to the lower age have significant correlation with BMI and age – 2) the correlations concerning age attain very numerous significant results more than those attained with BMI (11 versus 4) and with more high significant correlations, as shown by the values of the scores given to the degree of probability (from p <0,05 to p = 0,000). Based on the tables above it is possible to emphasize again that BMI is less related to the indexed variables, very differently that lower age, and it has to note that the correlations are better for lower

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BMI as well as for lower age. Lower BMI doesn't attain as many significant positive results respect to those attained by lower age, but the observation of the positive results in lower BMI lets to point out that in any case the significant correlations concern fundamental biologic variables, protidemia, albuminemia, hemoglobinemia, hematocrit, and the residual diuresis. Further separating the data of lower BMI in two groups based on data greater and lower the mean of lower BMI, it results in 3 significant correlations for greater data and 3 significant correlations for lower data, that is to say that the 4 significant correlations above increased to 6 significant correlations : observing the coefficients of variation of lower BMI and related data and those of the two subgroups it is possible to note that the coefficient of variation for lower BMI was 0,111 while the coefficients of variation of the two derived subgroups were respectively 0,031 and 0,06, that is to say that the data of BMI in the further lower subgroups strongly decreased their dispersion and the comparison of the overall mean and standard deviation of the coefficients of correlation of the subgroups did not show any significant difference between the groups, differently than in the intact values of BMI. In the following Tab. VIII are shown their descriptive statistics.

Tab. VIII Descriptive Statistics of the two formats of BMI							
Variable	N	Mean	St. Dev	Minimum	Median	Maximum	Skewness
BMI >mean ; greater data	5	24,35	0,75	23,11	24,49	25,157	-1,3
BMI < mean lower data	8	20,04	1,2	18,55	20	21,67	0,16

The difference between the two variables above is strongly significant : T value = 7,97, P = 0,000, DF = 10 and particularly it is possible to note the high difference of the skewness between : BMI > mean, greater data than BMI < mean : lower data. The skewness gives a measure of data dispersion respect to their mean (-1,13 versus 0,16), this strongly confirming the very lower dispersion of data for BMI when based on a more tight relationship weight-height.

Classifications of the correlations : table IX and Table X

The previously elaborations stated the degree of correlation of BMI and of age versus the selected variables listed in Materials and Method separately for males and females but also in the variable stated in their common grouping. In the following Table IX, A and B, and in Table X, A and B, are resumed the results of correlations with BMI and with age in terms of their statistic results, classified according to the attainment of a significant or not significant correlation, that is to say that the following tables IX an X point out the variables whose content is depending on BMI or on age : Males and females - Classifications of the variables according to the statistics significance of the correlations (significant – not significant correlation)

Tab. IX A - Males - Classification of the correlations

results of correlations based on BMI			
n	**not significant**	**n**	**significant**
1	Dialysis years	1	PD solutions 1,36 %
2	PD solutions 2,27 %	2	protidemia
3	PD solutions 3,86 %	3	Albuminemia
4	PD solutions Icodextrine	4	Hemoglobinemia
5	Residual diuresis	5	Hematocrit
6	Creatininemia	6	Lymphocytes
7	Azotemia	7	Dialyzed volume
8	Cholesterolemia		
9	Triglyceridemia		
10	CtCl liters/24h		
11	CtCl/week		

Tab. IX B - Females - Classification of the correlations

results of correlations based on BMI			
N	**not significant**	**n**	**Significant**
1	PD solutions 3,86 %	1	PD solutions 1,36 %
2	PD solutions Icodextrine	2	PD solutions 2,27 %
3	Residual diuresis	3	Protidemia
4	Creatininemia	4	Albuminemia
5	Azotemia	5	Hemoglobinemia
6	Cholesterolemia	6	Hematocrit
7	Triglyceridemia		
8	Lymphocytes		
9	Dialyzed volume		
10	CtCl liters/24h		
11	CtCl/week		

Tab. X A - Males - Classification of the correlations

results of correlations based on age			
n	**not significant**	**N**	**significant**
1	Dialysis years	1	PD solutions 1,36 %
2	PD solutions 2,27 %	2	Creatininemia
3	PD solutions 3,86 %	3	Azotemia
4	PD solutions Icodextrine	4	Protidemia
5	Residual diuresis	5	Albuminemia
6	Triglyceridemia	6	Cholesterolemia
		7	Hemoglobinemia
		8	Hematocrit
		9	Lymphocytes
		10	Dialyzed volume
		11	CtCl liters/24h
		12	CtCl/week

Tab. X B - Females - Classification of the correlations

results of correlations based on age			
n	**not significant**	**n**	**Significant**
1	PD solutions 2,27 %	1	PD solutions 1,36 %
2	PD solutions 3,86 %	2	Residual diuresis
3	PD solutions Icodextrine	3	Creatininemia
4	Triglyceridemia	4	Azotemia
5	Hematocrit	5	Protidemia
		6	Albuminemia
		7	Cholesterolemia
		8	Hemoglobinemia
		9	Lymphocytes
		10	Dialyzed volume
		11	CtCl liters/24h
		12	CtCl/week

Females lack the variables " dialysis years "

It is possible to note in the above Tab. IX A and B the correlations with BMI of males and of females. The numerousness of significant correlations differ between males and females and the common significant items concern the solutions of PD 1,36 % ,protidemia ,albuminemia, hemoglobinemia ,hematocrit, while dialyzed volume is significant for males and not significant for females. The Tabs. X A and B concern the correlations with age and it has to be emphasized that the list of significant items is almost independent by gender, the only difference concerning the residual diuresis, that is not significant for males. But the most important result is that the correlations with BMI (Tabs. IX A and IX B) include 7 significant correlations out 18 in males (38,89%) and 6 out 17 in females (35,29%), while the correlations with age (Tabs X A and X B) include 12 significant correlations out 18 in males (66,67%), and similarly in females (12 out 17) (70,59%), a further confirmation of the difference between the correlations based on BMI or on age. These results are compared each other in the following Tab. XI

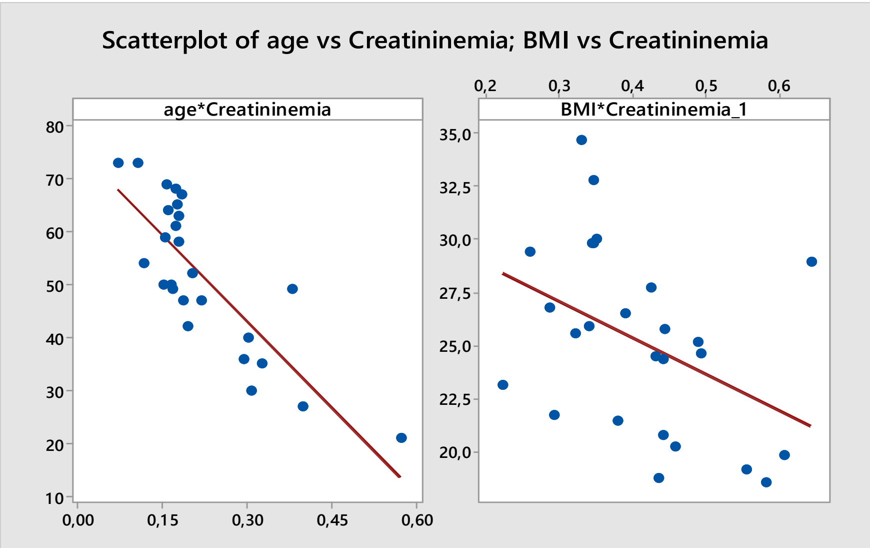
Tab. XI - Comparison by gender and by significant and not significant results of indexations on BMI and on age

significant BMI males	versus	T Test
significant BMI females	⟵	T value = 0,45, P 0,664, DF = 10
no significant BMI males	versus	T Test
not significant BMI females	⟵	T value =0,00, P = 1 , DF =22
significant age males	versus	T Test
significant age females	⟵	T value =0,00, P = 1 , DF =22
significant BMI males	versus	T Test
no significant BMI males	⟵	T value = -1,55, p 0,142, DF = 15
significant age males	versus	T Test
not signicant age males	⟵	T Value 2,32, p = 0,035, DF =15
significant age females	versus	T Test
not significant age females	⟵	T Value = 2,78, p =0,015, DF = 14

This comparison let to observe that the only significant differences of the variables concerning the indexations on BMI and on age are the differences between the significant and not significant indexations on age for males and for females, this further confirming the best performance of age versus that of BMI.

Discussion - A strong difference of results has been observed between the correlations of BMI with the data indexed on BMI and the correlations of age with the data indexed on age. This difference very probably bases on the difference of the peculiar characteristics of the two indexing variables. The age notoriously changes in time the bodily conditions quite similarly in all the aging subjects, with some differences between males and females, with eventual exceptions due to adverse conditions of life for a disease, or on the contrary particular physical conservation during the aging, due to a constant good health conditions and to a correct style of life [1]. Diversely, the BMI is a variable based on the relationship between height and weight, this last variable possibly undergoing significant changes, it may be also in relatively short times during the life, unlikely due to an increase of muscle mass, particularly if an increase of many kilograms and/or happened in sick subjects. It is possible to observe in the following Figure D the correlations of BMI and age with creatininemia where it is very clear the better regularity of the distribution concerning age. Based on all the results above, the BMI values could be used to normalize biological data only in the case that the weight should be in a correct proportion with height : in these cases the BMI values would be located between 18,9 and 24,9. In the subjects observed in this paper, the values of BMI was for males in 6 subjects 29,91±3,25 (outside the boundaries) and in the remaining 6 22,16±2,65 (inside the boundaries), a significant difference according to the T Test, T value 4,53, p =0,001, DF =9. In females, similarly the BMI values resulted to be 27,95±1,96 in 8 subjects (outside the limits) and 20,65±1,70 in the remaining 6 subjects (inside the limits), a significant difference according to the T Test, T Value = 3,42, p value = 0,011, DF = 7.

Figure D



In the bulk based on grouping males and females , the result is more significant . 14 subjects out 26 had a BMI greater than 24,9 (53,85%) and 12 had a BMI lower than 24,9 (46.15%), as resulting by the data above. The value of BMI greater than 24,9 is 28,48±2,84 and that lower than 24,9 results to be 21,41±2,26. The T Test between the different values was : T Value = 7,06, p = 0,000, DF = 23. . While for BMI the separation of subjects was stated in base of their location inside or outside the limits of normality, that is to say within 18,5 and 24,9, the separation of the subjects on base of age was based on the average value of age 51,88±14,41. The age greater than the average was 63,54±6,62 and the age lower than the average was 40,23±9,72. The related groups have the same number of subjects, and their comparison by T test results in T Value = 7,15, P = 0,000, DF = 21. The indexations on BMI causes per se a separation of the data in two different groups, because indexed on the values of BMI inside or outside the limits of its normality. Consequently, the use of BMI as indexing tool should have to be avoided when a population, whose variables should be indexed on BMI, have an excessive weight respect to height, to be considered very probably not due to an increased muscle mass,

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because having excessive size, but more probably due to an excessive body fat and/or to a fluid retention, as frequently it happens in subjects in end stage renal disease, as in the case of this research, or due to a cardiac decompensation, or due to both the two causes. The separation of BMI and the related indexed data in greater and lower BMI created two subgroups and the separation of the lower BMI and the related data in two further subgroups, attained data whose coefficient of correlations did not have the overall mean and standard deviation statistically different within the subgroups. That is to say that the lower is the size of BMI, the lower will be the dispersion of data indexed on BMI. In other words it confirms that BMI could be used as indexation tool only when the weight is in correct relationship with height. The very better results obtained by indexation on age are shown also in the last table, Tab XI , where the only significant result based on significant and not significant indexations on age for males and for females. All the considerations above concerning the different results attained indexing on BMI or on age let us to remind that, on the same base, the wide use of body surface area (BSA) should be left as indexation tool, because BSA is generally estimated using formulae based on height and weight, this driving to very possible misappreciations of indexed variables [2,3,4,5,6,8,9,10] and for this the indexations on BSA would be replaced by indexations based on the height [7] Furthermore, it would be took into account that the estimated BSA are based on different formulae, and this will generate different values also when concerning equal row data, this causing an impossibility of a correct comparison [5]. The quite difference of significant results of the correlations based on BMI versus those based on age is a new and interesting proof of the inadequate stability of BMI, because based on weight, to be used as an indexation tool.

Conclusions

All the results above, including the shown graphs, let to conclude that the best tool of indexation for any considered biologic variables in this research is represented by the years of age. It has to strongly emphasize that the actual variable genetically correlated with the changes of the biologic variables in time is the age, generally correlated with the changes in time of the biologic status, but with possible variations depending on the eventual negative or positive modifications respect to what waited for each age, due to negative evolutions often due to diseases, as in the case of the here studied subjects, or to incorrect style of life or heavy works or due to a combination of negative conditions, or positive evolutions due to a good maintaining of health in time, this depending on many different factors, variously combined each other. BMI could theoretically result in significant correlations with the biologic variables when in its correct boundaries, 18,5 – 24,9, and similarly for the weight in a correct relationship with the corresponding height : but contrary to this hypothesis, a model based on a BMI inside 18,5 and 24,9 created on random data, with the same variables indexed on the random BMI, resulted in not statistically significant correlations, with the only exception for the correlation with protidemia, p = 0,001,and with albuminemia, p = 0,001. On base of all what above, it should have to conclude that indexing on age the physiologic variables could be the best solution.

Essential References

1) Susanne C. Individual age changes of the morphological characteristics. Journal of Human Evolution, 6,; 2: 1977. Pages 181 – 189
2) Ruggieri G.. The difficulty to have a really correct measure and estimate of the actual Body Surface Area (BSA) can induce misconstruction of actual renal function and of the best dialysis prescription when indexed on BSA Conference UNINET Congress 2011.International Congress on line..Published on Research Gate
3) Ruggieri G. Is Body Surface Area (BSA) suitable for indexing renal and dialysis clearances and other physiological parameters? A theoretical approach and a critical analysis, (Part 2). La Clinica terapeutica 160(2): 2009. Pages 133-138
4) Ruggieri G. Is Body Surface Area (BSA) suitable for indexing renal and dialysis clearances and other physiological parameters? A theoretical approach and a critical analysis (Part 3). Clinica terapeutica 160(3):, 2009. Pages 233-241
5) Ruggieri G, Filippini A . The comparison of peritoneal creatinine clearances indexed to1,73 m² according to different formulae.. Published in Research Gate. December 2015
6) Ruggieri G. Impossibility of comparing data of indexed peritoneal dialysis clearance when different formulae of body surface area are used.. Nephrology@ Point of Care.1(1) ; 2011. Pages 49-56
7) Ruggieri G. A study of indexing on BSA or Height: A particular aspect of the difference between two methods of indexing. Published in Research Gate, February 2017
8) Ruggieri G., Rocca AR. Analysis of Past and Present Methods of Measuring and Estimating Body Surface Area and the Resulting Evaluation of Its Doubtful Suitability to Universal Application . Blood Purification 30(4): 5December 2010. Pages 296-305
9) Ruggieri G. Is Body Surface Area (BSA) suitable for indexing renal and dialysis clearances and other physiological parameters? A theoretical approach and a critical analysis. (Part 1) La Clinica terapeutica 160(1). 2009 pages 29-41
10) Ruggieri G. The Suitability of Models to Prefigure Organic Functions and to Avoid Item Dispersion. World Journal of Research and Review (WJRR) ISSN:2455-3956, Volume 4, Issue 4, April 2017 Pages 34-40