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ASSOCIATION OF CHANGES MAGNESIUM AND CHLORIDE LEVELS TO MUSCLE STRENGTH FOR PRE AND POST REGULAR HEMODIALYSIS PATIENTS

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Abstract
Introduction. One of the functions of the kidneys is as excretion function, especially electrolytes such as magnesium and chloride. Magnesium functions as a protein metabolism as well as the synthesis of mitochondrial ATP and has an important role in catalyzing more than 300 enzymatic reactions in the human body including protein synthesis, nerve and muscle transmission, and neuromuscular conduction. Chloride's function is currently unclear, but it can be identified that apart from being an acid-base balance and gastric acid, chloride is also important as a potential development of the membrane in muscle fibers. Regular hemodialysis patients always complain of muscle weakness which can be caused by muscle atrophy, muscle myopathy, reduced activity or a combination. Compared with normal patients muscle strength in regular hemodialysis patients can occur weakness
Method. This study is analytical with a cross-sectional retrospective design. Data were analyzed after distribution test, then mean difference and correlation test was using the SPPS program where $p < 0.05$ was considered statistically significant.
Results. This study showed not significantly for Magnesium and Chloride with muscle strength in Patients with Regular Hemodialysis.
Conclusion. Not significant association of changes Magnesium and Chloride levels to Muscle Strength for Pre and Post Regular Hemodialysis patients.

Introduction
Chronic kidney disease (CKD) is a pathologic condition that occurs gradually and is irreversible, characterized by structural and functional abnormalities in the kidneys that last more than three months with health implications and criteria in the form of decreased glomerular filtration rate (GFR) <60 ml / minute per 1.73 m2, as well as one or more markers of kidney damage. Another criterion that can occur is the body's ability to fail to maintain fluid and electrolyte balance[1].

One of the functions of the kidneys is as a function of excretion, especially electrolytes such as magnesium and chloride. Magnesium is the fourth most important cation in the body after sodium, calcium and potassium. The function of magnesium is carbohydrate, lipid and protein metabolism and mitochondrial ATP synthesis which is an important role in catalyzing more than 300 enzymatic reactions in the human body including protein synthesis, nerve and muscle transmission, and neuromuscular conduction.[2] Chloride function is currently unclear, but it is well known that in addition to being a kind of acid-base balance and gastric acid, chloride is also important as a potential development substance for the membrane in muscle fibers.[3]

Muscle strength during muscle contraction is influencing by several electrolytes such as sodium, potassium and calcium.[4] The complaint felt by patients undergoing routine hemodialysis is always about muscle weakness which is weaker than normal people. The muscle weakness is caused by reduced activity, muscle atrophy, muscle myopathy and neuropathy or a combination of both.[5] Checking muscle strength can be done in various ways, to check the strength of the hand muscles can be using a handgrip dynamometer, and for checking the muscle strength of the lower extremities can be used the Manual Muscle Test scale.

Many studies have shown that magnesium, chloride and several other electrolytes are related to muscle strength.

Method
This study uses a cross- sectional design, which is a one- off study that aims to discover the relationship between the independent variable and the dependent variable. The study was conducted at H. Adam Malik General Hospital in December 2019. Secondary data from medical records used as subjects of study, medical record data. A total

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of 20 subjects of study who met the inclusion and exclusion criteria using the consecutive sampling method, from patients who regular hemodialysis > 3 months.

Data analysis using the SPSS-22 (Statistical Product and Science Service) application. Data analysis carriying out by statistical tests using the t test, for independent variables and dependent variables that had numeric and categorical data types that were normally distributing, and the Wilcoxon test for data that were not normally distributed to compare the values of magnesium and chloride levels and muscle strength of patients with a routine hemodialysis. Pearson test. For normal data and abnormally distributed data, it is done using the Spearman test.

Result

This study took as many as 20 subjects to participate in this study. There are 13 men (65%) and 7 women (35%). The mean age of the study subjects was 52 ± 13 years. For the sample mean body weight, an average of 62 kg. The average length of hemodialysis was 5 months. The pre and post calcium results are 9. Magnesium has undergone changes before and after HD, and decreased after HD. After HD, Potassium content decreased slightly. The albumin value obtained was not far from the pre and post HD examination, the Hb value remained the same, namely 8.75 on average. Likewise, the chloride results did not change much. The handgrip and limb examination also did not have drastic changes, namely for the handgrip the mean value was 27-28 ± 5.5-5.8 and for the lower extremity examination the mean value was 4.3-4.8 ± 0.5 (Table.1)

Table 1. Characteristics of Subjects and Laboratory Result take before and after Hemodialysis

Characteristics	N= 20
Age	52,05 ± 13,4
Weight	62,23 ± 7,24
Gender	
Men	13 (65%)
Woman	7 (35%)
Duration HD	5,23 ± 3,9
Calcium	
Before	9,12 ± 0,91
After	9,9 ± 0,99
Mg	
Before	2,35 ± 0,57
After	1,92 ± 0,26
Potassium	
Before	4,4 ± 0, 82
After	3,24 ± 0,88
Albumin	
Before	3,45 ± 0,42
After	3,24 ± 0,88
Hb	
Before	8,75 ± 1,75
After	8,75 ± 1,75
Cl^-	
Before	98,55 ± 5,24
After	99,5 ± 3,13
Handgrip	
Before	28,5 ± 5,5
After	27,72 ± 5,78
Lower limb	
Before	4,6 ± 0,50
After	4,35 ± 0,49

Note: Mean ± SD (Standar Deviation); HD: *Hemodialysis*; Mg: *Magnesium*; Hb: *Haemoglobin*; Cl: *Chloride*
According to statistical tests, although physiologically muscle contractions plays act as electrolytes. There is no significant relationship (p> 0.05) between confounding variables of muscle strength before and after Hemodialysis.

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Table 2. Relationship of Confounding Variables Before Hemodialysis with Muscle Strength

	Hand grip	*P* Value	Lower limb	*P* Value
Calcium	0,043	0,857	0,133	0,576
Potassium	0.096	0,686	0,160	0,500
Albumin	0,008	0,972	0,169	0,477
Duration HD	0,352	0,128	0,018	0,940

Note: HD: *Hemodialysis*

Table 3. Relationship of Confounding Variables After Hemodialysis with Muscle Strength

	Hand grip	*P* Value	Lower limb	*P* Value
Calcium	0,149	0,530	0.228	0,334
Potassium	0,166	0,484	0,100	0,674
Albumin	0,191	0,419	0,073	0,759
Duration HD	0,174	0,463	0,138	0,561

Note: HD:*Hemodialysis*

In the results of this study, there was no significant correlation between changes in magnesium and chloride levels in patients before and after hemodialysis and changes in grip strength or lower limb muscle strength, with p> 0.05.

Table 4. Correlation of magnesium and chloride levels with muscle strength before hemodialysis

	Magnesium	*P*	Chloride	*P*
Hand grip	0,131	0,582	0,342	0,140
Lower limb	0,195	0,410	0,338	0,146

Table 5. Correlation of magnesium and chloride levels with muscle strength after hemodialysis

	Magnesium	*P*	Chloride	*P*
Handgrip	0,287	0,221	0,147	0,538
Lower limb	0,173	0,466	0,101	0,672

Discussion

In this study, the 20 research subjects, their majority of research subjects were male, as many as 13 people (65%) with a mean age of 52 ± 13.37. This study concurs with a study conducted by Hwang in Taiwan where the mean age of end-stage kidney disease was 51.10 ± 7.48. This fact is also in line with the report from the IRR in 2017 where the largest proportion of patients who underwent HD was in the age range 45-64 years. The age factor, in this case aging, can affect the regulatory structure and function of the kidneys, which can lead to the progression of worsening of CKD. The study subjects also found that body weight was determined as the inclusion criteria so that there were no different results when measured. The average weight found 62.23 ± 7.24. This research concurs with that conducted by Leenders (2018) in Amsterdarm, where the average body weight studied was 73.6 ± 14.8.

In this study, a number of laboratory parameters examining as confounding variables of the study. The results were not significant in this study, namely levels of calcium, potassium, hemodialysis time and albumin taken before and after the hemodialysis with p >0.05. This event is inversely proportional to the research conducted by Cunningham that found that the results were different even though normal levels finding, and Leenders who said that magnesium levels could be influenced by magnesium dialysate during hemodialysis. In this study, found that potassium levels were found to be significant and in accordance with research conducted by Anwar which was found with P <0.001. The calcium levels studied were found to experience differences in values before and after hemodialysis with p <0.011. This can also be influenced by the concentration of dialysate used during hemodialysis. This is in accordance with Farsad's research, where a study was carried out by measuring magnesium in hemodialysis patients, and the concentration of dialysate was found to have a relationship in influencing levels in the body during hemodialysis.

It can seeing in medical physiology books that the general mechanism of muscle contraction relating to the presence of an action potential, that is influenced by several electrolytes such as sodium, calcium, potassium, magnesium, and chloride which are exchanged from intracellular to extracellular in muscle fibers. This has been discussed in the fluid balance mechanism, which is based on the Donnan balance. Sodium, calcium, potassium

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and magnesium are intracellular fluids that play a role in the action potential process. While chloride is an extracellular ion, when these electrolytes change position, a muscle contraction-relaxation process will occur. In this study, there was no significant relationship between electrolytes and muscle strength which was checked before and after hemodilysis. The electrolytes obtained from the samples were different but still in normal conditions. This is in accordance with the research of Sakaguchi, et al and Mahardika et al, where there will be an effect on muscles when electrolyte conditions occur below normal.

There are limitations of this study, first, that there are still too few samples taken into account and the use of scales in lower extremity examinations where there can be different ratings if different researchers carriying out in assessing the patient's lower limb muscle strength. Second, Relatively to normal values of magnesium and chloride from laboratory tests performed. Third, From the sources, there is not much data about chloride, which is knowing in the study only on the heart muscle.

Conclusion

There was no significant relationship between Magnesium and Chloride with muscle strength either by the handgrip or examination of lower limb muscles both before and after the hemodialysis.

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