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Full Length Research Paper

Oxidative stress and power in patients post - kidney transplantation: a cross study

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The kidneys perform vital functions of our body and they endocrine function, metabolism and excretion. With the development of chronic kidney disease, these functions are compromised requiring that substitutive treatments are incorporated. Kidney transplantation is presented as the potential cure for end-stage Chronic Kidney Disease, providing lower morbidity and improved quality of life for individuals. This study evaluated the dietary intake and nutritional status of the patient post - transplanted kidney and its relationship with oxidative stress and oxidative defense. This was a cross-sectional study, quantitative, analytical with 12 patients of both genders, age 25 to 80 who had undergone renal transplantation more than one year. Data were processed with the help of the SPSS statistical package (versão 18.0, Chicago, IL, USA). The descriptive analysis is presented as mean, standard deviation, relative and absolute frequency. For quantitative variables was performed the Kolmogorov-Smirnov normality test, and for parametric we used the t test (Student) and for non-parametric U test (Mann Whitney) to compare the averages. In the qualitative variables, we used the chi-square test and Fisher's exact Pearson. To correlate parametric variables we used the Pearson test and nonparametric Spearman test. we obtained 11 (91,7) individuals of the sample with high blood pressure and nutritional status of overweight $27,70 \pm 5,19$ kg/m² and high waist circumference $98,37 \pm 14,75$ cm. The consumption of NSAIDs for females was significant ($p = 0,022$). The consumption of foods such as banana, bergamot, papaya, tomato, salsa, milk and coffee prevailed in the questionnaire with food intake of one or more times a day. Malondialdehyde levels were associated with significant when antioxidant enzymes and not as significant portions of the vitamins (A, C, D, E). The non-verification of GPx levels were characterized as a limiter of this study. it is noticeable that the power directly influences the antioxidant defense system of the body in tandem with the antioxidant enzymes CAT, SOD and GPx. Significant levels of malondialdehyde have stronger relationship with the antioxidant enzymes than with food; however, there are dietary factors - nutrients - that serve as cofactors in the process of antioxidant defense. Thus, the post patient's food - renal transplant must meet the principles of healthy eating, with minimal processed foods with a view to fresh food, in order to limit the impacts of everyday life, their grievances and drugs on health, thereby minimizing the metabolic stress.

Keywords: antioxidants, oxidative stress, chronic renal failure, kidney transplantation, biomarkers.

List of Abbreviations

AINE, Non steroid anti-inflammatory; BIA, Electrical bioimpedance; CA, Abdominal circumference; CAT, Catalase; DCV, Cardiovascular disease; DM, Diabetes Mellitus; DRC, Chronic Kidney Disease; EO, Oxidative Stress; GPx- Glutathione peroxidase; HAS, Systemic Hypertension; IMC, Body Mass Index; Kg, Kilograms; MDA, Malondialdehyde; NO, Nitric oxide; QFCA, Food Consumption Frequency Questionnaire; SOD, Superoxide Dismutase; TBARS, Thiobarbituric Acid; TX, Transplantation

INTRODUCTION

The kidneys perform vital functions of our body and they endocrine function, metabolism and excretion. With the development of chronic kidney disease (CKD), these functions are compromised requiring dialysis and hemodialysis treatments that are incorporated (Riella and Martins, 2013).

Kidney transplantation is a healing option for the patient with chronic kidney disease, as it can improve survival and reduce morbidity and mortality rate of these patients. Kidney transplantation is the surgical implantation of a kidney in patients who are chronic kidney failure or end-stage stage 5 (Wilkins and Juneja, 2010). According Rigatto (Rigatto, 2010), the interaction between obesity and immunosuppressive therapy leads to various effects such as the development of risk factors for cardiovascular disease, which contributes to high incidence of premature cardiovascular death in patients after renal transplantation, regardless of the pretransplant nutritional status.

With the completion of renal transplantation, the use of immunosuppressive drugs, anti-diabetic, anti-hypertensive drugs and vitamin supplements may be administered; lead is a very important metabolic change with frequent imbalance between production / destruction of free radicals, leading to oxidative stress frame.

According to Bianchi & Antunes (Bianchi and Antunes, 1999), the imbalance between oxidants and antioxidants molecules that results in inducing cell damage by free radicals has been called oxidative stress.

Based on oxidative stress (OS) related to the free radical theory, the antioxidants are the first line of choice for the prevention of stress. Antioxidants are substances capable of inhibiting oxidation, decreasing the concentration of free radicals in the body and/or chelating metal ions, preventing lipid peroxidation. The formation of free radicals in vivo occurs via catalytic action of enzymes during the electron transfer processes that occur in cellular metabolism and exposure to exogenous factors (Barreiros and David, 2006; Pieniz et al., 2009).

Therefore, such foods are exogenously to provide antioxidants and because of all the process of stress the body suffered and still suffers from transplantation to maintenance of the same, this study evaluated the dietary intake and nutritional status the patient post-transplanted kidney and its relationship with oxidative stress and oxidative defense.

METHODS

This research was developed in conjunction with the activities of the institutional project extension "Patient Assessment Post - Renal Transplant". This project, linked to the Department of Life Sciences of UNIJUÍ in partnership with the Ijuí Charity Hospital.

This research is characterized as a cross-sectional study, quantitative, analytical, it was measured the weight (kg) with scale brand Uranus maximum weight 180 kg and 2.5 kg with minimum 100g division. Height was measured in centimeters with tape measure attached to a wall with no baseboard, with a length of 2.00 m, divided into centimeters and subdivided into millimeters with the aid of a wooden square, positioned at the top of the head in order to promote a more accurate reading of stature. The body mass index ($BMI = \text{weight}/\text{height}^2$) was calculated after carrying out two above-mentioned techniques.

The waist circumference (WC = cm) was measured with the standard tape aid and measured at the time of the umbilicus, with the patient standing and with arms relaxed at your sides. It was also held bioelectrical impedance analysis - BIA. The resistance and reactance measurements used to calculate the bioelectrical impedance analysis were obtained with a model analysis instrument BIA 101 Q - portable, manufactured by RJL Systems Inc. The measurement was performed with the subject lying supine on his right side put the electrodes on hand and foot. The legs were apart from each other, avoiding contact ankles and knees and hands and arms were removed from the body.

The skin where the electrodes were placed was cleaned with cotton soaked with alcohol. The electrodes were placed on an imaginary line that divides the head of the ulna and starts in the bone fist bump. The other electrode was placed above the middle finger node. On foot, the electrode was placed in an imaginary line that divides the medial and lateral malleolus.

The other was placed above the middle toe node. The black phone cables were placed in the distal electrodes, and red cables in the proximal electrodes. The connection clamps (alligators) of black color were connected to the distal electrodes (near the fingers), and the connection clamps (alligators) of red color were connected in the proximal electrodes (wrist and ankle). After this procedure with the power on was performed reading of the resistance and reactance, which together

Table 1. Characterization of the sample according to age, disease, cardiovascular risk factors, donor type and time of renal transplantation.

	Male (n=10)	Female (n=2)	Total (n=12)	P
Age	53,00± 7,62	57,00± 12,73	53,67± 8,04	0,589£
Pathological Base n(%)				1,000†
SAH	3(60)	2(100)	5 (71,4)	
DM	2(20)	0(0)	2(14,3)	
Unknown	2(20)	0(0)	2(14,3)	
FRCVascu				
SAH	9(90)	2(100)	11(91,7)	1,000†
DM	5(50)	1(50)	6(50)	1,000†
Sedentarism	4(40)	1(50)	5(41,7)	1,000†
Smoking	0(0)	0(0)	0(0)	-
Alcoholism	0(0)	0(0)	0(0)	-
Dyslipidemia	5(50)	1(50)	6(50)	1,000†
Donor				1,000†
Alive	6(75)	1(50)	7(70)	
Dead	2(25)	1(50)	3(30)	
Time of Transplantation	6,37± 6,89	19,41	8,23± 7,99	0,134£

FRCV: cardiovascular risk factors; DM: Diabetes Mellitus; SAH: Systemic Hypertension. †: Fischer exact test; £: Test U – Mann Whitney; *: $p \leq 0,05$, statistically significant.

with old data, sex and physical activity level were entered into *software* that came with the device for carrying out the analysis resulted in the assessment of body composition by amounts of water, fat mass and lean body mass, calculated by the generalized equations.

The sample consisted of 12 patients of both genders who had undergone renal transplantation more than one year and were followed up at the Hemodialysis industry Ijuí Charity Hospital. The Food Consumption Frequency Questionnaire (FFQ) was completed with the help of the reference Zabotto CB, RPT Viana, Gil MF, et al. (Zabotto et al., 1996), which presents illustrative figures of food portions, in order to facilitate the understanding of equivalent portions.

For purposes of calculation of the amount of servings of each vitamin consumed by participants, the foods were separated into four groups, they group vitamin A (sweet potatoes, carrots, spinach, pumpkin, broccoli, tomatoes, liver, egg yolk, figs, beets, milk, curry and basil), vitamin C (orange, bergamot, strawberry, grape, pineapple, banana, lemon, guava, papaya, parsley, cabbage, lentils, pepper, bay leaf, oregano, green tea, black tea, wine and coffee), vitamin D (sardines) and vitamin E (olive oil, butter, nuts, nut-nut, wheat bran, peanuts, oats, flaxseed, whole grain bread, pasta and brown rice). Foods were classified only in a group of antioxidant vitamins.

As oxidative stress and oxidative damage indicators were determined plasma concentrations of Malondialdehyde (MDA) by TBARS technique - as indicator of lipid peroxidation - and CAT and SOD - like antioxidant enzymes - the oxidative stress and oxidative damage indicators were determined concentrations of plasma malondialdehyde (MDA) by TBARS technique -

the indicator of lipid peroxidation - and CAT and SOD - like antioxidant enzymes -.

Data were processed with the help of the SPSS statistical package (version 18.0, Chicago, IL, USA). The descriptive analysis this presented as mean, standard deviation, relative and absolute frequency. For quantitative variables was performed the Kolmogorov-Smirnov normality test, and for parametric we used the t test (Student) and for non-parametric U test (Mann Whitney) to compare the averages.

In the qualitative variables, we used the chi-square test and Fisher's exact Pearson. To correlate parametric variables we used the Pearson test and nonparametric Spearman test.

All participants signed the Informed Consent to participate in research. This study was approved by the Research Ethics Committee of the Regional University of Northwest of the State of Rio Grande do Sul - Unijuí, on June 16th, 2014; under the advice of number 700.720.

RESULTS AND DISCUSSION

The sample consisted of 12 subjects while they were 10 males and 02 females. The sample average age was 53,67±8,04 years old and the transplant time average 8,23±7,99 years. The graft organ from a living donor was the most frequent, 7 (70) subjects (Table 1).

Among the underlying conditions for the development of chronic kidney disease systemic arterial hypertension (SAH) is the most prevalent cause 05 (71.4) and is the most frequent pathology among individuals 11 (91.7),

Table 2. Comparison between genders, according to anthropometric data, classification of nutritional status and body composition by the values of water, lean body mass and fat mass.

	Male (n=10)	Female (n=2)	Total (n=12)	P
Height (cm)	167,40±5,98	158,50±6,36	165,91±6,7	0,085¥
Weight (kg)	76,14±14,85	77,100±21,78	76,300±14,96	0,936¥
CA (cm)	97±14,31	105,25±20,85	98,37±14,75	0,497¥
BMI	27,19±5,15	30,26±6,43	27,70±5,19	0,472¥
Class. BMI n(%)				0,500†
Eutrophy	3(30)	0(0)	3(25)	
Overweight	3(30)	1(50)	4(33,3)	
Obesity I	3(30)	0(0)	3(25)	
Obesity II	1(10)	1(50)	2(16,7)	
BIA				
% Water	57,90±4,53	47,00±3,54	56,16±5,86	0,013¥*
Fat mass (kg)	16,54±7,52	27,60±11,31	18,38±8,74	0,162£
Lean body mass (kg)	56,91±8,18	49,15±10,96	57,86±9,07	0,143¥

CA: Abdominal Circumference; BMI: Body Mass Index; Class. BMI: Classification of Body Mass Index; BIA: Electrical Bioimpedance; †: Fischer exact test; ¥: Student's T-test; £: Test U – Mann Whitney; *: $p \leq 0,05$, statistically significant.

being considered as a risk factor for developing cardiovascular disease.

The following is the diabetes mellitus (DM) with 06 (50) individuals, dyslipidemia with 06 (50) individuals and a sedentary lifestyle with 05 (41.7) individuals. There were no participants who had a history of alcoholism or smoking. In a study Moreira (Moreira et al., 2010) points out how the main complications in the post-transplant period later obesity, dyslipidemia, hypertension, malnutrition, diabetes mellitus, disorder in calcium metabolism and renal bone disease.

Hypertension (prevalent disease in the study population) leads to a slow and silent imbalance in the body, triggering a series of injuries often difficult to control, as in the case of chronic kidney disease. According to the VI Brazilian Cardiology Directive (Sociedade Brasileira de Cardiologia et al., 2010) the overall prevalence of hypertension among both genders is similar, although it is higher in males up to 50 years.

According to Table 2, the male presents stature of 167,40±5,98 cm and females 158,50±6,36 cm, and the sample average height of 165,91±6,7 cm. The average weight found in the sample was 14,96±76,300 Kg. Nutritional assessment of the sample elucidated that there are 03 patients on the nutritional status of normal weight, 04 overweight, 03 in obesity grade I and 02 in class II obesity. No patients were underweight.

One can say that individuals tend to nutritional risk of obesity since the nutritional assessment of both sexes reached a mean BMI 27,70±5,19 kg/m², which corresponds to a nutritional diagnosis of overweight associated to high Ca levels in both sexes, ending an average of 98,37±14,75 cm CA in this population, which predisposes the risk of developing coronary heart disease and cardiovascular disease (CVD) at an early

stage (Sociedade Brasileira de Cardiologia et al., 2010).

Studies show that excess body mass weight, measured by BMI, may have direct or inverse association with mortality, depending on the characteristics of the population as well, the accumulation of abdominal fat constitutes an independent risk factor for cardiovascular disease, dyslipidemias, diabetes, hypertension, oxidative stress and inflammation with significant repercussions on the total fat or peripheral (Freitas et al., 2013).

Riella & Martins (Riella and Martins, 2013) highlight that patients receiving kidney tx have their lipid profile changed due to the use of diuretics and beta-blockers and that obesity has a positive correlation with the chronic inflammatory process and development of CVD, which is a risk factor for graft rejection. It can be identified by evaluating the values of the BIA body compartments of both sexes. Males had lean body mass 56,91±8,18 kg and females showed 49,15±10,96 kg, so these values are below the recommended level for each genus second RJL Systems Analysis program software Inc.

The fat mass values for males were 16,54±7,52 kg being below normal, however women had 27,60±11,31 kg, being above recommended. The body water values are expressed in percentages. The body water in males was 57,90±4,53 being within the normal range, as in females the percentage of body water was low 47,00±3,54, obtaining an average of 56,16±5,86 statistically significant ($p = 0,013$). Even the male body water amount presenting normal, this value is the lower limit of the same, which suggests that the consumption of water for both genders is low and there is greater presence of fatty tissue.

It is known that in the aging process there is an increase in body fat with consequent reduction of water and fat-free mass in the body (Sampaio and Figueiredo,

Table 3. Relationship between the genders of the sample and the classes of medications administered.

	Male (n=10)	Female (n=2)	Total (n=12)	P
Medications n(%)				
Anxiolytic	0(0)	1(50)	1(10)	0,200†
Antacid	3(37,5)	1(50)	4(40)	1,000†
Antidepressant	1(12,5)	1(50)	2(20)	0,378†
Antidiabetic (insulin)	0(0)	1(50)	1(10)	0,200†
Oral Antidiabetic	2(25)	0(0)	2(20)	1,000†
Aines	0(0)	2(100)	2(20)	0,022†*
Beta-blockers	2(25)	1(50)	3(30)	1,000†
Sodium Channel Blockade	4(50)	1(50)	5(50)	1,000†
Diuretic	6(75)	1(50)	7(70)	1,000†

Aines: Non-steroidal anti-inflammatory drug; †: Fischer exact test; *: $p \leq 0,05$, statistically significant.

2005), concomitantly, the continued use of immunosuppressive drugs and other drug classes needed for these individuals also influences significantly in metabolism of macronutrients (carbohydrates, proteins and lipids) modifying the body composition of users, leading to the meeting of the irregularities obtained in the evaluation of BIA (Moreira et al., 2010).

Study by Rigatto (Rigatto, 2010) suggests that the interaction between obesity and immunosuppressive therapy induces the development of several risk factors for cardiovascular disease, which contributes to high incidence of premature death in patients post - transplant.

Cardiovascular disease is the most common cause of mortality in renal transplant recipients and, although no immunosuppressive drug has been directly associated to cardiovascular events, it is known that the immunosuppressants have different impacts on the traditional risk factors. The corticosteroids and cyclosporin are agents with stronger impact on weight gain, blood pressure and serum lipids. The use of Tacrolimus is associated with increased risk of early-onset diabetes mellitus and the use of sirolimus and everolimus has the greatest impact on risk factors for post-transplant hyperlipidemia (Marcén, 2009).

According to Table 3 there was the use of anti-inflammatory drugs (NSAIDs) in 02 (100) females which is statistically significant data ($p = 0,022$). NSAIDs are among the most consumed drug classes in the world. Constitute a group of therapeutic interest as they have analgesic, antipyretic and anti-inflammatory properties that make them very attractive, however, as well as other drugs, NSAIDs have the potential to cause adverse effects on various body systems can induce or exacerbate hypertension blood or lead to renal failure, nephrotic syndrome and other disorders related to renal system as well as the other bodily systems (Melgaço et al., 2010).

In a study by Light et al. (Luz et al., 2014) found that the prevalence of NSAID use is two times higher in women than in men ($p < 0,001$) in agreement with the

data obtained in this study. Since women have higher BMI and WC that the sample men, women tend to higher risk of developing bone and rheumatic diseases due to excess weight and physiological imbalance of body compartments linking directly to the fact that women make most NSAID use in order to minimize the symptoms of pain and inflammation, in addition to these, exhibit greatest care onset of diseases and seek information (Bandeira et al., 2013).

The antioxidant defense system serves to inhibit and/or reduce the damage caused by harmful action of free radicals or non-reactive oxygen species. Usually this system is divided into enzymatic and non-enzymatic system, which latter comprises exogenous sources - Dietary - (Barreiros and David, 2006; Barbosa et al., 2010; Verçosa, 2012). Consumption of foods containing antioxidants is of paramount importance to the protection and tissue repair in the body. According to Bianchi & Antunes (Bianchi and Antunes, 1999)

"Vitamins C, E and β -carotene are considered excellent antioxidants, able to sequester free radicals with great efficiency ... Antioxidant defenses of the organism can be restored with proper diets and vitamin supplements".

The antioxidant micronutrients are essential for the antioxidant defense network, and the inadequate supply of these through diet has been epidemiologically correlated with increased risk of degenerative diseases (Polidori, 2003).

After transplantation, recovery of appetite, termination of dietary restrictions and side effects of immunosuppressive agents usually cause weight gain and consequent obesity status - a serious problem after transplantation, occurring in 50% of patients (Alencastro et al., 2013).

A balanced diet based on the food groups that make up the food pyramid is able to provide the individual sufficient supply of antioxidant nutrients for body

Table 4. Correlation between pathologies, cardiovascular disease risk indicator of oxidative stress and antioxidant enzymes.

	Yes (n=6)	No (n=6)	Total (n=12)	p
DM				
MDA	27,69±16,33	26,47±12,89		0,904¥
CAT	0,007±0,002	0,002±0,002		0,863¥
SOD	-0,48±0,79	-0,77±0,29		0,745£
SAH	(n=11)	(n=1)	(n=12)	p
MDA	27,01±13,54	-		-
CAT	0,007±0,001	0,009		0,100¥
SOD	-0,581±0,59	-1,100		0,105£
DYSLIPIDEMIA	(n=6)	(n=6)	(n=12)	p
MDA	25,08±15,04	29,42±13,17	27,01±13,54	0,664¥
CAT	0,007±0,002	0,007±0,002	0,007±0,002	0,603¥
SOD	-0,467±0,78	-0,783±0,31	-0,63±0,59	0,871£

DM: Diabetes Mellitus; SAH: Systemic Hypertension; MDA: Malondialdehyde; CAT: Catalase; SOD: Superoxide dismutase; £: Test U – Mann Whitney; ¥: Student's T-test; *: p ≤ 0,05, statistically significant.

maintenance. The powers of the post-renal transplant patients should follow the parameters that govern healthy eating as his "new" health condition allows consume any food. However, careful food choices must endure throughout life, stressing the preference for the consumption of fresh food and less processing thus promoting a healthy lifestyle and keeping individuals away from complications with the graft and underlying diseases.

Front of the Food Consumption Frequency Questionnaire applied to this population, one can identify some of the preferences and the frequency in the consumption of food sources of antioxidants. Among the consumption of food categorized as always (1 or more times daily) pointed to banana and bergamot (58,3%), papaya (50%), tomato (58,3%), parsley (58,3%), milk (83,3%), coffee (66,7%) and olive oil (41,7%); in frequent categorized as (1 or more times a week) stood out the cabbage (66,7%), pasta and bread (58,3%); categorized as highlighted in never to guava (75%), fig (58,3%), wheat bran, oats, linseed (66,7%), brown rice (58,7%), sardines (66,7%), the curry (91,7%), bay leaf and basil (66,7%), Brazil nuts (83,3%), butter (83,3%), wine (91,7%); black tea (58,3%) and the consumption of multivitamins and polyminerals which was not reported by any of the research participants.

In study by Barroso et al. (Barroso et al., 2010), it was the daily consumption of oregano and oatmeal, a rare consumption of black tea, lentils and parsley as well as the denial of wheat bran consumption, laurel and fig resembling the results obtained in this study.

The antioxidant defense system is extremely important for protection against oxidative stress and intensification of cell damage by free radical production. Antioxidants

food plays dual role in the defense system, as well as providing active antioxidant compounds (non-enzymatic system) they offer nutrients that act as cofactors in the antioxidant defense system of the body. Different foods are studied by having vitamins and minerals with antioxidant function to promote the maintenance of inventories antioxidants of the organism through the intake of certain food groups or controlled nutrient supplementation (Nemzer et al., 2014).

The quality of the diet can influence the oxidative status of the cells. The ingestion of fruits and vegetables are rich in vitamins enhances the antioxidant potential, especially in the blood (Silva and Jasiulionis, 2014). Thus, the search for a complete nutrition that provides all the nutrients needed by the body is necessary to avoid nutritional deficiencies and provide adequate antioxidant defense system, minimizing the production of free radicals and consequent metabolic stress (Polidori, 2003; Nemzer et al., 2014).

When the production of free radicals and/or reactive species exceeds the capacity of action of antioxidants, it favors the formation of biomolecules, generating specific metabolites, oxidative stress markers (Barbosa et al., 2010). Table 4 is not obtained significant p values due to some limiting as the low number of individuals in the sample, lack of biochemical example of fasting blood glucose, glycated hemoglobin and triglyceride levels. It is known that increased blood glucose levels (hyperglycemia) have pro-oxidative effect to the body favoring the status of metabolic stress and free radical formation at the cellular level, because it reduces levels of nitric oxide (NO) activating the aldose reductase. The increased flow by way of polyols, driven by an increase in reactive oxygen species, determines most sorbitol

Table 5. Correlation between antioxidant enzymes, oxidative stress, body mass index, protein damage and total antioxidant vitamins portions of a sample of renal patients post-transplant.

	p	r
MDA		
SOD	0,004	0,0843£*
CAT	0,765	-0,116¥
VIT. A	0,824	0,087¥
VIT. C	0,178	0,492¥
VIT. E	0,317	0,377¥
VIT. D	0,127	-0,548£
BMI		
MDA	0,865	-0,067¥
CAT	0,377	-0,280¥
SOD	0,775	0,092£
PROTEIN DAMAGE		
IMC	0,693	0,127¥
CAT	0,383	0,277¥
SOD	0,528	-0,203£
VIT. A	0,129	0,464¥
VIT. C	0,123	0,470¥
VIT. E	0,557	-0,189¥
VIT. D	0,796	-0,084£

BMI: Body Mass Index; MDA: Malondialdehyde; SOD: Superoxide dismutase; CAT: Catalase; ¥: Student's T-test; £: Test U – Mann Whitney; *: $p \leq 0,05$, statistically significant.

glucose conversion, reducing NADPH and glutathione (intracellular antioxidant) and increasing the oxidative stress induced by hyperglycemia (Reis et al., 2008).

Table 5 demonstrates a negative correlation between the levels of MDA and CAT ($p = 0,765$, $r = -0,116$), which expresses the CAT enzymatic defense is higher than the MDA levels, demonstrating that when increases the activity of this enzyme there is a reduction in oxidative stress. Since the correlation between MDA and SOD was statistically significant ($p = 0,004$).

However, it was not checked levels of the antioxidant enzyme glutathione peroxidase (GPx), which is a limiter of our study. But it should be noted that the increase in CAT and GPx activity depends on the activity of SOD enzyme, due to the fact that they are sequential reactions in endogenous antioxidant activity. Another aspect to be highlighted is the significant relationship between MDA and SOD which shows the importance the dependence of enzymatic activity of GPx and CAT in reducing oxidative stress, as when just this and other associated enzymes do not alter the activity provides up-one oxidative stress frame evidenced by the rise of MDA.

There was no significance between vitamin portions of the FFQ and the MDA level, suggesting that MDA this

more associated with activity of antioxidant enzymes in which it is observed significant result between SOD and MDA and no significant between CAT and MDA, fitting to point out that only SOD is not a significant result of antioxidant defense and this also depends on CAT and GPx to convert H_2O_2 in H_2O , which is observed by negative relation between MDA and CAT.

The CAT and GPx act in synergy, in order to prevent hydrogen peroxide accumulation. This integration between the enzymes is of paramount importance, since this reactive species, through the reactions of Fenton and Haber-Weiss, with the participation of iron and copper metals, culminating in the generation of $OH \cdot$, against which there is no system defense. The activity of the above enzymes, often depends on the participation of enzyme cofactors, especially antioxidants of dietary origin, which corroborates the assertion that individuals who have low intake of antioxidant vitamins present deficit in antioxidant defense process favoring the oxidation of lipids, and high levels of MDA (Barbosa et al., 2010; França et al., 2013). Therefore, linking the BMI MDA level, a negative correlation was obtained ($r = -0,067$), which indicates that the smaller the BMI MDA levels, ie, the lower the level of oxidative stress.

CONCLUSIONS

The production of free radicals with subsequent occurrence of oxidative stress is a physiological process that occurs continuously in the body, however, in patients post - kidney transplant due to the use of various drugs and the development of chronic diseases rather than the underlying disease the production of reactive oxygen species is higher, favoring the occurrence of stress.

The nutritional overweight condition with high waist circumference association and fat body mass above normal characterized the studied sample as individuals at nutritional risk with strong indications of developing cardiovascular disease over a lifetime and have complications related to the graft. It is noticeable that the power has a direct influence on the antioxidant defense system of the body in tandem with the antioxidant enzymes CAT, SOD and GPx. Significant levels of malondialdehyde showed stronger relationship with the antioxidant enzymes than with food, however, there are dietary factors - nutrients - that serve as cofactors in the process of antioxidant defense.

The role of the professional nutritionist front of patients post - transplant is of utmost importance in order to promote healthy lifestyles and guide them as the consequences of a poor diet compared to the transplanted organ and metabolic changes occurred. Thus, the post patient's food - renal transplant must meet the principles of healthy eating, with minimal processed foods with a view to fresh food, in order to limit the impacts of everyday life, their grievances and drugs on health, thereby minimizing the metabolic stress.

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