

were avoided from any form of vigorous muscular exercise for at least 6 hours prior to the sample collection.

Materials and Reagents

- Cobalt chloride (1g/l): Analytical quality cobalt chloride was purchased from Sri Durga laboratory supplies, Chillimbi Main Road, Mangalore - 575006.

- Dithiothreitol (1.5g/l): Analytical quality Dithiothreitol was purchased from Sri Durga laboratory supplies, Chillimbi Main Road, Mangalore - 575006.

Sodium chloride (Normal saline was purchased from Yenagoa medical store).

Reagent preparations

- Cobalt chloride solution(1g/l): 0.1g of cobalt chloride was dissolved in 100 ml of distilled water. The solution was kept in brown bottle in dark till use.

- Dithiothreitol (1.5g/l): 0.15g of DDT was dissolved in 100ml of distilled water. The solution was kept in brown bottle in dark till use.

Procedure for Cobalt Binding Test Assay.

- To 200µl of serum, 50µl of cobalt chloride solution was added followed by vigorous mixing and incubated for 2 minutes in dark at room temperature.

- 50µl of Dithiothreitol solution was added followed by vigorous mixing and 2 minutes of incubation at room temperature in dark.

- The blank was prepared similarly by excluding Dithiothreitol. The solution was read in spectrophotometer at 470nm and the IMA values were recorded in Absorbance Units (ABSU).
- The same procedure was repeated for the control sample

Table of Results

S/ No	Age	sex	RBS (Mg/dl)	Creatinine (Mg/dl)	IMA (ABSU)
1	73	M	107	7.6	0.188
2	65	M	415	3.7	0.195
3	38	M	193	10.4	0.437
4	73	F	95	8.7	0.161
5	51	F	74	4.5	0.234
6	48	F	196	0.8	0.162
7	49	M	79	5.1	0.123
8	55	M	110	12.7	0.197
9	55	M	94	1.5	0.183
10	46	M	36	9.1	0.185
11	56	M	127	0.6	0.344
12	61	F	134	1.4	0.553
13	57	M	93	2.3	0.196
14	55	M	337	9.7	0.168

14	55	M	337	9.7	0.168
15	41	F	186	12.9	0.258
16	48	F	125	7.1	0.277
17	58	F	225	2.1	0.337
18	25	M	123	15.6	0.178
19	59	M	102	9.8	0.415
20	23	F	121	5.5	0.178

Sl/No	Total protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	Urea (mg/dl)
1	6.4	3.2	3.2	68
2	6.3	4.2	3.0	53
3	7.2	3.4	3.4	175
4	6.5	3.0	2.7	98
5	6.5	3.3	3.3	48
6	7.5	4.0	3.5	196
7	7.0	3.5	3.9	70
8	7.8	3.9	2.9	137
9	5.1	2.2	3.2	85
10	6.6	2.5	5.2	12
11	8.0	2.7	3.6	48
12	6.4	2.8	3.7	118
13	6.8	3.4	3.6	74
14	7.4	4.1	3.2	185
15	7.3	3.8	2.8	47
16	6.4	3.5	3.7	35
17	6.8	3.4	3.8	102
18	7.7	3.6	2.8	96
19	7.3	3.1	3.7	67
20	6.4	3.5	3.6	49

Table 3: Experimental IMA levels in Control group.

Sl no.	1	2	3	4	5	6
IMA(ABSU)	0.39	0.125	0.062	0.098	1.42	0.42

Discussion and conclusion.

The present study evaluated that the amount of serum ischemia modified albumin from 20 serum sample from 8 females and 12 males of age bracket 23-73 years suffering from chronic kidney disease (CKD) and had undergone dialysis. The amount of IMA was notably and significantly increased in the dialytic CKD patient (0.26880 ± 0.17385) compared the control group (0.09033 ± 0.40332). These finding reveal that IMA amount in serum can be used as a biomarker in accessing the degree of chronic infections of the kidney. It's still remained a question to be answered by future study how the concentration of IMA varies in

different stages of prediabetes, diabetes and chronic diabetes in order to bring out what different concentrations predict about the fatal threat of CKD. Despite IMA being elevated in dialytic CKD patient, previous reported several other conditions under which IMA can be significantly elevated most notably in cardiovascular and this suggest that IMA cannot be used as a specific and definite biomarkers of CKD dialytic patients. The protein components of kidney functional test (albumin, globulin and total protein) show significant correlation with serum IMA. Total protein was found to be significantly positively correlated to IMA implying that IMA level seems to strongly depend on the total protein and perhaps suggest that the amount of serum IMA should be made in reference to serum albumin levels, for example IMA/albumin ratio. Further comparative analysis of pre-renal and post renal IMA concentrations with respect to total protein, globulin and albumin could give more incites on the intensity of the CKD. Globulin had significant correlation to IMA levels as well as

albumin. Use of large sample size could however bring out more clear significant correlations between these variances. Serum concentration of Random Blood Sugar and urea had very insignificantly

List of Abbreviations

IMA: Ischemia Modified Albumin.

ACB: Albumin Cobalt Binding

ABSU: Absorbance Units

CKD: Chronic Kidney Disease.

RBS: Random Blood Sugar.

DTT: Dithiothreitol.

References.

1. Sbarouni, E., Georgiadou, P., Koutelou, M., Sklavainas, I., Panagiotakos, D. and Voudris, V., 2009. Ischaemia-modified albumin in dilated cardiomyopathy. *Annals of clinical biochemistry*, 46(3), pp.241-243.

2. Chen, X., Lin, Y., Tian, L. and Wang, Z., 2020. Correlation between ischemia-modified albumin level and coronary collateral circulation. *BMC Cardiovascular Disorders*, 20(1), pp.1-

3. Erdem, S.S., Kurban, S., Altunhan, H., Annagür, A., Örs, R., Yerlikaya, F.H., Gökçe, R. and Mehmetoğlu, İ., 2011. Ischaemia-modified albumin

levels in newborn jaundice before and after phototherapy. *Cell biochemistry and function*, 29(6), pp.521-525.

4. Yarcı Gursoy, A., Ozdemir, E.D., Ozdemir, H., Candar, T. and Caglar, G.S., 2017. Ischaemia-modified albumin in preeclampsia: A critical view. *Journal of Obstetrics and Gynecology*, 37(3), pp.305-308.

5. Du, L., Ma, J., He, D. and Zhang, X., 2019. Serum ischaemia-modified albumin might be a potential biomarker for oxidative stress in amnesic mild cognitive impairment. *Psychogeriatrics*, 19(2), pp.150-156.

6. Xiao, L.L., Zhang, F., Zhao, Y.L., Zhang, L.J., Xie, Z.Y., Huang, K.Z., Ouyang, X.X., Wu, X.X., Xu, X.W. and Li, L.J., 2020. Using advanced oxidation protein products and ischaemia modified albumin to monitor oxidative stress levels in patients with drug-induced liver injury. *Scientific reports*, 10(1), pp.1-10.

7. Karataş, Z., Baysal, T., Şap, F., Alp, H. and Mehmetoğlu, I., 2014. Increased ischaemia modified albumin is associated with inflammation in acute rheumatic

fever. *Cardiology in the Young*, 24(3), pp.430-436.

8. Inal, H.A., Ozturk Inal, Z., Mermer, S., Aksoy, E., Bayraktar, A.M. and Can, U., 2020. Investigation of serum vitamin D and ischaemia-modified albumin levels in infertile Turkish men. *Andrologia*, 52(3), p.e13507.

9. Giannone, F.A., Domenicali, M., Baldassarre, M., Bartoletti, M., Naldi, M., Laggetta, M., Bertucci, C., Colecchia, A., Viale, P., Bernardi, M. and Caraceni, P., 2015. Ischaemia-modified albumin: a marker of bacterial infection in hospitalized patients with cirrhosis. *Liver International*, 35(11), pp.2425-2432.

10. Sinha, M.K., Gaze, D.C., Tippins, J.R., Collinson, P.O. and Kaski, J.C., 2003. Ischemia modified albumin is a sensitive marker of myocardial ischemia after percutaneous coronary intervention. *Circulation*, 107(19), pp.2403-2405.

11. Sinha, M.K., Gaze, D.C., Tippins, J.R., Collinson, P.O. and Kaski, J.C., 2003. Ischemia modified albumin is a sensitive marker of myocardial ischemia after percutaneous coronary intervention. *Circulation*, 107(19),

pp.2403-2405.

12. Abboud, H., Labreuche, J., Meseguer, E., Lavallee, P.C., Simon, O., Olivot, J.M., Mazighi, M., Dehoux, M., Benessiano, J., Steg, P.G. and Amarenco, P., 2007. Ischemia-modified albumin in acute stroke. *Cerebrovascular Diseases*, 23(2-3), pp.216-220.

13. Gunduz, A., Turedi, S., Mentese, A., Altunayoglu, V., Turan, I., Karahan, S.C., Topbas, M., Aydin, M., Eraydin, I. and Akcan, B., 2008. Ischemia-modified albumin levels in cerebrovascular accidents. *The American journal of emergency medicine*, 26(8), pp.874-878.

14. Piwowar, A., Knapik-Kordecka, M. and Warwas, M., 2008. Ischemia-modified albumin level in type 2 diabetes mellitus—preliminary report. *Disease markers*, 24(6), pp.311-317.

15. Turedi, S., Gunduz, A., Mentese, A., Karahan, S.C., Yilmaz, S.E., Eroglu, O., Nuhoglu, I., Turan, I. and Topbas, M., 2007. Value of ischemia-modified albumin in the diagnosis of pulmonary embolism. *The American journal of emergency medicine*, 25(7), pp.770-773.

16. Duarte, M.M., Rocha, J.B.,

- Moresco, R.N., Duarte, T., Da Cruz, I.B., Loro, V.L. and Schetinger, M.R., 2009. Association between ischemia-modified albumin, lipids and inflammation biomarkers in patients with hypercholesterolemia. *Clinical biochemistry*, 42(7- 8), pp.666-671.
17. Ellidag, H.Y., Bulbuller, N., Eren, E., Abusoglu, S., Akgol, E., Cetiner, M. and Yilmaz, N., 2013. Ischemia-modified albumin: could it be a new oxidative stress biomarker for colorectal carcinoma? *Gut and liver*, 7(6), p.675.
17. Awadallah, S.M., Atoum, M.F., Nimer, N.A. and Saleh, S.A., 2012. Ischemia modified albumin: An oxidative stress marker in β -thalassemia major. *Clinica Chimica Acta*, 413(9-10), pp.907-910.
18. Roy, D., Quiles, J., Sharma, R., Sinha, M., Avanzas, P., Gaze, D. and Kaski, J.C., 2004. Ischemia-modified albumin concentrations in patients with peripheral vascular disease and exercise-induced skeletal muscle ischemia. *Clinical chemistry*, 50(9), pp.1656-1660
19. Kaefer, M., Piva, S.J., De Carvalho, J.A., Da Silva, D.B., Becker, A.M., Coelho, A.C., Duarte, M.M. and Moresco, R.N., 2010. Association between ischemia modified albumin, inflammation and hyperglycemia in type 2 diabetes mellitus. *Clinical biochemistry*, 43(4-5), pp.450-454.
20. Ellidag, H.Y., Eren, E., Yilmaz, N. and Cekin, Y., 2014. Oxidative stress and ischemia modified albumin in chronic ischemic heart failure. *Redox Report*, 19(3), pp.118-123.
21. Guven, S., Alver, A., Mentese, A., Ilhan, F.C., Calapoglu, M. and Unsal, M.A., 2009. The novel ischemia marker 'ischemia-modified albumin' is increased in normal pregnancies. *Acta obstetrica et gynecologica Scandinavica*, 88(4), pp.479-482.
22. Worster, A., Devereaux, P.J., Heels-Ansdell, D., Guyatt, G.H., Opie, J., Mookadam, F. and Hill, S.A., 2005. Capability of ischemia-modified albumin to predict serious cardiac outcomes in the short term among patients with potential acute coronary syndrome. *Cmaj*, 172(13), pp.1685-1690.
23. Sbarouni, E., Georgiadou, P.,

- Theodorakis, G.N. and Kremastinos, D.T., 2006. Ischemia modified albumin in relation to exercise stress testing. *Journal of the American College of Cardiology*, 48(12), pp.2482-2484.
24. Lippi, G., Montagnana, M. and Guidi, G.C., 2006. Albumin cobalt binding and ischemia modified albumin generation: an endogenous response to ischemia? *International journal of cardiology*, 108(3), pp.410-411.
25. Kumar, A., 2012. Ischemia-modified albumin: its diagnostic implications and shortfalls. *Journal of Biomedical Sciences*, 1(3).
26. Oran, I. and Oran, B., 2017. Ischemia-modified albumin as a marker of acute coronary syndrome: the case for revising the concept of “N-terminal modification” to “fatty acid occupation” of albumin. *Disease markers*, 2017.
27. Cichota, L.C., Moresco, R.N., Duarte, M.M.M.F. and Silva, J.E.P.D., 2008. Evaluation of ischemia-modified albumin in anemia associated to chronic kidney disease. *Journal of Clinical Laboratory Analysis*, 22(1), pp.1-5.
28. Ma, Y., Kang, W., Bao, Y., Jiao, F. and Ma, Y., 2013. Clinical significance of ischemia modified albumin in the diagnosis of doxorubicin-induced myocardial injury in breast cancer patients. *Plos one*, 8(11), p.e79426.
29. Gaze, D.C., Crompton, L. and Collinson, P., 2006. Ischemia-modified albumin concentrations should be interpreted with caution in patients with low serum albumin concentrations. *Medical Principles and Practice*, 15(4), pp.322-324.
30. Göker, A.E., Alagöz, M.H., Güntaş, G., Yilmazer, A.B., Berkiten, G., Tutar, B., Ekincioglu, M.E., Akgun, M.F., Uyar, Y. and Ozdemir, E., 2019. Evaluation of serum ischaemia-modified albumin levels in patients with Bell's palsy. *The Journal of Laryngology & Otology*, 133(9), pp.810-813.
31. Stea, S., Pasquale, D., Beraudi, A., Catalani, S., Amabile, M., Bracci, G. and Toni, A., 2019. Ischemia-Modified Albumin Expression: Is there a Difference between Male and Female Subjects. *Clinical laboratory*, 65(6).
32. Gunduz, A., Turkmen, S., Turedi, S., Mentese, A., Yulug, E.,

Ulusoy, H., Karahan, S.C. and Topbas, M., 2009. Time-dependent variations in ischemia-modified albumin levels in mesenteric ischemia. *Academic Emergency Medicine*, 16(6), pp.539-543.

32. Jiao, D., Guo, F., Yue, M. and Tian, Z., 2020. Ischemia-modified albumin is associated with arterial stiffness in hemodialysis patients. *International heart journal*, pp.19-489.

© GSJ