**Original Research Article**

**Study on Adiponectin Uric acid and CRP in pre-diabetic and diabetic subjects**

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**ABSTRACT**

**Background:** Diabetes and pre-diabetes are always on the rise over the past decade, but little is known about the development of type 2 diabetes mellitus dysfunction in young adults. The study was conducted in prediabetic and diabetic patients in order to belong to anti-inflammatory hormone adiponectin, proinflammatory marker uric acid in these patients, and also to determine the role of these markers in future CVD risk.

**Material & Methods-** This case-control study was conducted at Rama Medical College & Hospital, Mandhana Kanpur. Out of 400 participants recruited, 140 subjects were control, 140 were pre-diabetics, and the remaining 120 were controlled. The detailed history of the patients regarding age, gender, height, weight, and family history regarding obesity and other chronic illness was taken. Patients with medical complications or diseases and conditions that may affect levels of biochemical markers were excluded from the study. The data analysis was done using SPSS 16 and the results were reported as mean ± SD where p<0.05 has been considered as statistically significant.

**Results-** The adiponectin level was significantly decreased and CRP, Uric acid levels were significantly increased in both the groups (Pre-diabetes and diabetes) as compared to control. Similarly, basic parameters including WHR, BMI, HbA1c, fasting blood glucose were also increased.

**Conclusion-** The study showed that pre-diabetes and diabetes are diseases of inflammatory origin with a high level of proinflammatory molecules. These mediators are not only the potent risk factors for pre-diabetes and diabetes but also mediate significant future CVD risk in these patients.

**Key Word:** Adiponectin, Uric acid, CRP, Pre-diabetic, Diabetes Mellitus.

**INTRODUCTION**

On ithe ibasis iof ivarious istudies iconducted iamong idiabetic isubjects, iit iis iclear ithat iit iis ian iinflammatory idisorder. i[1] iThe inormoglycemic iindividual iexperiences ia istage iof ilatent ihyperglycemia ii.e. iprediabetic iphase ibefore ideveloping idisease. iDevelopments iof iphases ifrom inormoglycemia, ito iprediabetic iand ifurther ito idiabetic istate, iare iall imanifested iby iinsulin iresistance istatus. iAnd ithat iis ialso ihallmark iof ithe iinflammatory iresponse. iUric iacid iwhich iis ione iof ithe ipurine icatabolic iproducts isynthesized iin ivivo ifrom iglutamate iand I 5-phosphoribosyl ipyrophosphate i[2] iand iseveral iepidemiological istudies ihave iimplicated istrong iinfluence iof iUA iin iseveral iconditions ilike iinsulin iresistance, iobesity, ihypertension, imetabolic isyndrome, idiabetes iand irenal idiseases. i[2] iRaised ilevel iof iUA ilevel ihas ialso ibeen iseen iin iprediabetic isubjects iand ithe ioffspring iof idiabetes ipatient itoo. iCurrent ifew istudies ihave ishown ithe iimportant irole iof iUA iin iimmune iactivation iand ithereby irelease iof icytokines.[3] iThese imolecules ipotentially imediate iboth iendothelial idysfunction iand iphase iof iinflammation iand ioxidative istress iin imetabolic isyndrome. iHigher ilevel iof iUA imay ipose iindividual iwith ihigher irisk iof idiabetes ias iper iliterature isearch.[4]Antioxidant iand ipro-oxidant irole iof iUA iis iwell istudied iand iestablished.[5] iRaised iUA ilevel ihas ialso ibeen ireported ito ishow iits ieffect ion ipancreatic iB icell iapoptosis ivia iactivating iseveral isignal itransduction ipathways.[6] iThe istudy iwas iplanned iin iprediabetic iand idiabetic ipatients iin iorder ito ipertain ian ianti-inflammatory ihormone iadiponectin, iproinflammatory imarker iuric iacid iin ithese ipatients iand ialso ito idetermine irole iof ithese imarkers iin ifuture iCVD irisk. i

**MATERIAL** I**AND** I**METHODS**

Our istudy iwas ia icase icontrol istudy iwhich iwas iapproved iby iethical icommittee iof iRama iMedical iCollege i& iHospital iKanpur, iUP iIndia. iOut iof i400 iparticipants irecruited, iof iwhom i140 isubjects iwere icontrol, i140 iwere ipre-diabetics iand iremaining i120 iwere icontrol. iDetailed ihistory iof ithe ipatients iregarding iage, igender, iheight, iweight iand ifamily ihistory iregarding iobesity iand iother ichronic iillness iwas itaken. iPatients isuffering ifrom iany imedical icomplications ior idiseases ior iany iother iconditions ithat imay iaffect ilevels iof iinflammatory imarkers iwere inot iconsidered iin ithe istudy. iBlood isamples ifrom ithe irecruited istudy isubjects iwere icollected iand ithe iseparated iserum ior iplasma iwas iused ifor ibiochemical ianalysis. iAll ithe iparameters iincluding iroutine i(FBG, iHbA1c) iand iinflammatory iparameters i(Adiponectins, iUric iacid i& iCRP) iwere ianalyzed iappropriately iusing istandard ikits. iThe idata ianalysis iwas idone iusing iSPSS i16 iand ithe iresults iwere icalculated ias imean i± iSD iwhere ip<0.05 ihas ibeen itaken ias istatistically isignificant. iThe icomparison iof iassayed iparameters iamong icontrol i& iprediabetic igroup, icontrol i& idiabetic igroup iand iprediabetic i& idiabetic igroup iwas idone iby istudent i– it itest i(unpaired). iTo idetermine ithe iassociation, ipearson’s icorrelation itest iwas iapplied. i

**RESULT**

In ithis istudy, ithe iadiponectin ilevel iwas isignificantly idecreased iand iCRP, iUric iacid ilevels iwere isignificantly iincreased iin iboth ithe igroups i(Pre-diabetes iand idiabetes) ias icompared ito icontrol. iSimilarly ibasic iparameters iincluding iWHR, iBMI, iHbA1c, iFasting iblood iglucose iwere iincreased. iIn ithe istudy icardiac irisk iindices iwere ialso iestimated iand isignificantly ihigh irisk iwas idocumented iin ipatient igroup iwith iprofoundly iraised ilevels iin idiabetic igroup i**(Table** i**1&2)**. iRegarding icorrelation ianalysis, iadioponectin iin iboth iprediabetic iand idiabetic igroups icorrelated iinversely iwith iCRP i(r/p i= i-0.32/<0.001, i0.6/<0.001), iuric iacid i(r/p= i-0.14/0.09, i-0.2/0.024) irespectively. iSimilarly ithe iIndices ifor icardiac irisk iCRR, iA1, iAC i& iAIP ishowed iinverse iassociation ito iadiponectin i(r/p i= i-0.31/<0.001, i-0.29/< i0.001, i-0.29/< i0.001, i-0.29/<0.001 iin iprediabetic igroup; i-0.45/<0.001 i& i-0.41/<0.001, i-0.45/< i0.001 i& i-0.49/<0.001 iin idiabetes irespectively); iand ithe ilinear iassociation iwith iCRP( ir/p=0.24/0.004, i0.22/0.008, i0.24/0.004 iand i0.19/0.22 iin ipre-diabetes iand i0.71/ i< i0.001, i0.67/<0.001, i0.71/< i0.59/<0.001) iin idiabetes irespectively, iuric iacid i(r/p=0.13/0.119, i0.12/0.15, i0.13/0.119 iand0.1/0.231 iin ipre-diabetes; i0.29/<0.001, i0.28/<0.001, i0.29/<0.001 iand i0.22/ i0.013 iin idiabetes irespectively). I

**Table** i**1-** i**Basic** i**parameter** i**among** i**control,** i**pre-diabetic,** i**diabetic** i**group**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameters | Control | Pre-diabetes | Diabetes | p ivalue |
| BMI | 23.23±1.97a\* | 23.98±2.39c | 24.35±2.72b\*\* | <0.001 |
| WHR | 0.85±0.08 ia\*\* | 0.91±0.12c | 0.91±0.12b\*\* | <0.001 |
| Fating iBlood iGlucose | 0.840±6.99 ia\*\* | 116.63±5.15c\*\* | 160.49±40.15b\*\* | <0.001 |
| HbA1c | 5.06±0.44 ia\*\* | 5.97±0.2c\*\* | 8.63±1.18b\*\* | <0.001 |

Statically isignificant-\* i ip<0.05

a- iControl i& pre-diabetes ib- iControl i& idiabetes ic- iPre-diabetes i& idiabetes

**Table** i**2-** i**Correlation** i**among** i**adiponectin,** i**CRP** i**&** i**UA** i**in** i**pre-** i**diabetes,** i**Diabetes** i**and** i**control** i**subjects**

|  |  |  |  |
| --- | --- | --- | --- |
| Parameters | Pre-diabetic | Diabetic | P ivalue |
| Adiponectin | 8.21±1.97 | 6.74±2.04 | <0.001 |
| CRP | 4.29±3.2 | 5.25±1.85 | <0.001 |
| Uric iAcid | 4.58±0.95 | 6.36±1.9 | <0.001 |

p<0.001= iSignificant

**DISCUSSION**

Diabetes imellitus, ione iof ithe iimportant ihealth iissue iof i21st icentury, iaffecting imillions iof ilife iwhich iis imainly iattributed ito iphysical iinactivity, istress, ichanges iin iliving ihabit. iBasic iparameters iincluding iBMI, iWHR, iFBG, iHbA1c iwere ievaluated ibetween idifferent igroups iand ifound ito ibe isignificantly iraised ipre-diabetic iand idiabetic igroup i(>0.05 iin iboth ithe igroups). iThe ioutcome iof istudy iwas iin isupport iof iprevious istudies idone. iAdela iet ial ialso ireported iraised iFBG iin isubjects icompared ito icontrol. i[7] iSimilarly iUpadhyay iS iet ial i[8] iand iJagmohangaihi iD iet ial,. i[9] iAlso idocumented isignificantly ihigh iBMI, iHbA1c, iFBG. iDifferences iwere imore isignificant iin idiabetics ias icompared ito ipre-diabetic igroup. i

Adiponectin iis ian ianti-inflammatory iadipokine. iThe ilevel iof iadiponectin iwas iapparently iless iin iboth ithe igroups i(pre i& idiabetes) iin icomparison ito ihealthy icontrol. iSupporting ievidences ito ithe iobservation iof istudy iwere iprovided iby iUpadhyayaet ial, i[8] iwho ialso ishowed isignificantly ilow iadiponectin ilevel iin iIFG iand ihyperglycemic igroup ias icompared ito inormoglycemic igroup. iFurther isupporting ievidences iwere igiven iby ijiang iY iet ial i[10] iwho ishowed isignificant idifferences iin iadiponectin ilevel iin iboth ithe isubject igroups ias icompared ito icontrol igroup. iFisher iMF i[11] iet ial ialso ireported isimilar iresults. iAccording ito iYaturu iS iet ial i[12] iadiponectin iis ione iof ithe iimportant ifactors ipredicting ipre-diabetes. iProtective irole iof iadiponectin iagainst ihyperglycemia ican ibe icorrelated iwith iits iinsulin isensitizing ieffects13. iMechanistic iapproaches idemonstrate ithat iadiponectin istimulates iAMP idependent iprotein ikinases, i[14] iThereby itrigger iinsulin isensitivity iby ienhancing iglucose icellular iuptake, ifatty iacids ioxidation iin ithe iliver. iAccording ito iOkada iIM iet ial, ioral isupplementation iof iAdipo iR iagonist ican iserve ias ia ipromising itherapeutic ioption iinsulin iresistance iand idiabetes. i[15]

CRP iis imost icommon iacute iphase iinflammatory imarker igenerated iby iliver. iSeveral iobservational istudies ihave idemonstrated iwell idiabetes iincidence iand iassociation iwith iCRP. iResults iof iour istudy iwere iin ialliance iwith ithat iof iShreshtha iet ial i[16] iand imany iothers iwho ishowed iorderly iincrease iof iCRP ilevels ifrom icontrol igroup ito iprediabetic iand ito idiabetic igroup. iConsistent iresults iwere ialso iobserved iin ithe istudy iof iSabnayagam iC iet ial i[17] iand iGupta iet ial,[18] iwho ishowed ihigh iCRP ilevel iin iprediabetic igroup. iThough ifewer istudies ihave ifocused ion iethnic ivariations iwith iregard ito iassociation iof iCRP iwith ipre-diabetes.[19]The ielaborated imechanism ithat ilinks ihyperglycemia iwith iCRP ilevel imay ibe iexplained iin iparts iwith iinsulin iresistance.[20] iUric iacid ihas ibeen ireported ito iserve ias ia imarker ifor iblood iglucose imetabolic ialterations.[2] iThis istudy idocumented isignificantly ihigh iuric iacid iconcentration iin idiabetic isubjects i(with irespect ito iprediabetic, idiabetic iand icontrol igroup). i iStudy iconducted iby iKhan iSA iet ial ireported isimilar iresults. i[21] iThe ilevel iprogressively iincreased ifrom icontrol igroup ito iIFG ito ihyperglycemic igroup ithereby ihighlighting ithe isignificance iof iuric iacid ifunction iin ithe ipathogenesis iof idiabetes. iRao iet ial iand ia inumber iof iother iworkers ialso ireported isimilar iresults.[22] iSome istudies isuggested, ithough iuric iacid ilevel iis ilow iin idiabetes, iraises iagain idue ito irenal iinsufficiency.[23] iPossible imechanism iof isuch ivariations iin iuric iacid ilevel imay ibe ireduced isynthesis iand ialtered iexcretion iof iand iincreased iconsumption ias ian iantioxidant.[23]

iAs iper icorrelation ianalysis iall ithe ibasic iparameters iwere isignificantly iand iinversely icorrelated iwith iadiponectins. iThese ireports iwere ianalogous iwith imany iresearches iincluding iHina iet ial,[24] iUslu iS iet ial, i[25] iAlam iR iet ial,[26] ireported isignificant iinverse icorrelation iof iadiponectin iwith iHbA1c iand iBMI ibut ithe icorrelation iwas iinsignificant iin icase iof iage, idiabetes iduration, iinsulin iand iglucose ilevel. i

**CONCLUSION**

The istudy ishowed ithat ipre-diabetes iand idiabetes iare idiseases iof iinflammatory iorigin iwith ihigh ilevel iof iproinflammatory imolecules. iThese imediators iare inot ionly iare ipotent irisk ifactors ito ipre-diabetes iand idiabetes ibut ialso imediate isignificant ifuture iCVD irisk iin ithese ipatients. iTherefore iearlier iscreening iof ihigh irisk iindividuals iis isuggested iso ias ito iprevent ionset iof idiabetes idevelopment. i

**ACKNOWLEDGMENT:** i

We iwould ilike ito ithank iDepartment iof iBiochemistry, iRama iMedical iCollege, iHospital i& iResearch iCentre, iIndia.

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Date of Publishing: 05 June 2021

Author Declaration: Source of support: Nil, Conflict of interest: Nil

Ethics Committee Approval obtained for this study?  YES

Was informed consent obtained from the subjects involved in the study?  YES

For any images presented appropriate consent has been obtained from the subjects: NA

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DOI: 10.36848/IJBAMR/2020/29215.55627