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# Correlation of Serum Uric Acid with Intelligence in Medical and Dental Students of a Medical College in Kathmandu

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## ABSTRACT

**Introduction:** History cites many pioneers and doyens in their fields to have suffered from gouty attacks due to hyperuricaemia. This study is aimed to explore on the assumption that the blood uric acid and intelligence are correlated.

**Methods:** A cross-sectional study was conducted in Department of Clinical Biochemistry of KIST Medical College and Teaching Hospital (KISTMCTH) from March 2019 to June 2019. Total of 109 first year medical and dental students of KISTMCTH were included in this study after their written consents. Serum uric acid was assessed in the auto analyzer Siemens dimension by the Uricase enzymatic method. The intelligence was determined by using "The Wechsler Adult Intelligence Scale—Fourth Edition". Data collected were tabulated in SPSS 21 and correlational analysis was done.

**Results:** Mean Intelligence Quotient (IQ) score was 99.72 (SD 12.882) and mean uric acid was 5.2. IQ was graded from low average to very superior, out of which 66 (60.6%) were average, 16 (14.7%) were high average, six (5.5%) were superior, two (1.8%) were very superior and remaining were low average. On comparing IQ with Uric acid level no statistically significant correlation was obtained.

**Conclusion**: In our study, serum UA level in medical and dental students is found to have no correlation with their IQ.

**Keywords**: Intelligence quotient, Serum uric acid, Medical and Dental students

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## INTRODUCTION

Uric acid (UA) which is chemically 2, 6, 8 trioxypurine is an organic compound that is endogenously produced by humans and is the end product of purine metabolism. It is generated during the breakdown of nucleic acids (DNA and RNA) and Adenosine Tri-Phosphate. It is formed by the liver and mainly excreted by the kidneys (65-75%) and intestines (25-35%). Uriase is an enzyme that oxidizes uric acid to water soluble allantoin which gets freely filtered by kidneys, however its absence in a human body compared to mammals limits the excretion of uric acid. This is the main reason why serum UA levels in human beings are higher (~6.0 mg/dl) compared with the majority of mammals (<0.5–1mg/dl). [1,2]

History cites many pioneers and doyens in their fields to be victims of hyperuricaemia and excruciating gouty attacks and victims include Isaac Newton, Charles Darwin, Harvey, Sydenham, Alexander the Great just to name a few.[3] Thus the alleged association of uric acid and high intelligence, significant correlation between UA levels and higher intelligence in children and young adults have been found by several authors.[1,4] However, other authors have not seen this association between UA and higher intelligence.[5] In Nepalese population various studies regarding the prevalence of hyperuricaemia[6] have been conducted but till date, no study has been done regarding the correlation of serum uric acid and intelligence of the population. So, the present study will help understand association of intelligence quotient (IQ) with uric acid levels in healthy young adult medical and dental students who are enrolled in first year.

## METHODS

This is a cross sectional study. This study was conducted among 109 first year medical and dental students. Ethical clearance was taken from Institutional review board of KIST Medical College. Data was collected from March 2019 to June 2019. A convenient sample of healthy students without any known chronic illness, acute infection, vascular diseases and family history of Gout and willing to participate was taken for the study. Written consent was taken from the participants. The variables included were age, sex and IQ. The IQ was determined by using The Wechsler Adult Intelligence Scale—Fourth Edition (WAIS–IV) [7] which is the gold standard test for measuring IQ.[8] The test is designed to measure intelligence and cognitive ability in adolescents and adults. WAIS-IV is composed of 10 core subtests and five supplemental subtests, with the 10 core subtests yielding scaled scores that sum to derive the Full Scale IQ. It took 60-90 minutes to complete the test in one student. Based on full scale IQ score, IQ was further categorized as low average (80-89), average(90-109), high average(100-119), superior(120-129) and very superior(130 and above).

The blood sample was obtained by withdrawing 3 ml of venous blood in plain vacutainer under aseptic conditions by trained laboratory staff. Blood sample were obtained within one week of performing IQ test. Serum uric acid was analyzed by enzymatic Uricase method using fully automated analyzer (Siemens Dimension) which works on the principle of spectrophotometry. The data was entered in Microsoft excel and data was analyzed using SPSS 21. Data was presented in form of frequency, percentage and correlation analysis was done using Pearson chi square test.

## RESULTS

Out of total 109 students 62 (56.9%) were Female and 47 (43.1%) were male. Uric acid level was higher in males compared to females. (Table 1)

**Table 1. Sex and UA**

| Sex | Mean UA | N |
|---|---|---|
| Male | 6.232 | 47 |
| Female | 4.497 | 62 |
| Total | 5.245 | 109 |

Mean age of students was 18.17. Mean IQ score was 99.72 (SD 12.882) and mean uric acid was 5.2. (Table 2)

**Table 2. Age, UA and IQ**

| | Age | UA | IQ |
|---|---|---|---|
| Mean | 18.17 | 5.24 | 99.7 |
| Median | 18 | 5 | 98 |
| S.D | 0.792 | 1.51 | 12.8 |

IQ was graded from below average to very superior, out of which 66 (60.6%) were average, 16 (14.7%) were high average, 6(5.5%) were superior, 2 (1.8%) were very superior and remaining were low average.

On comparing IQ with UA level no statistically significant correlation was observed (R=-.028, P=.776) at p<0.05. (Fig: 1)

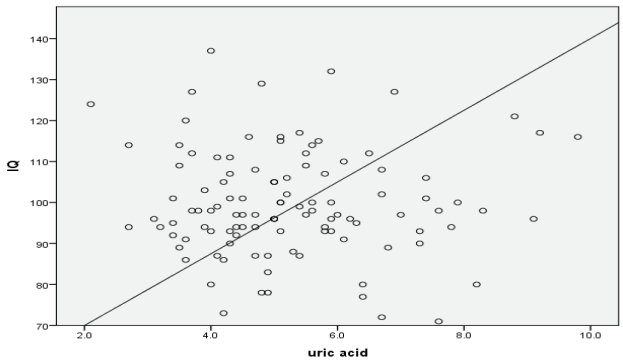


**Figure 1 : Correlation analysis of uric acid with IQ.**

Similarly, there was no significant correlation of sex ($X^2$= 40.648, p = .574) and diet ($X^2$= 37.294, p = .716) with full scale IQ score and between diet and uric acid level ($X^2$=28.556 / p =.994)

## DISCUSSION

The increase in UA levels is assumed to have given rise to quantitative and qualitative leaps in the intellectual capacity of humans in the evolutionary process. It has been suggested that UA is able to stimulate the cerebral cortex which could have allowed humans to develop higher brain mass volume, better intellectual performances, and maybe evolutionary supremacy.[9] Thus the superior intellectual power of humans may partly be due to higher levels of UA. Consistent with this idea is the finding that glutamic acid, which is involved in the endogenous production of UA, seemed to improve cognitive functions when given therapeutically in cases of intellectual disability.[1] In our study UA level was higher in male compared to female which is in accordance with most of the studies.[10]

Numerous studies were performed evaluating the uric acid levels of the general population and of special groups (university professors, students) to see if a general relationship between uric acid and I.Q. and other intelligence tests could be identified. One such study was done by Patil et al. who investigated a cohort of medical students, and showed that mean serum UA in subjects with high IQ (> 160) was higher than in subjects with normal IQ (81-120).[7] Similar results were obtained in a study done by Rajaa Alhasan where a positive correlation was obtained between the serum uric acid level and IQ among the medical college students volunteers.[11] Various studies done to find the association of cognitive performance in healthy subjects as well as people with comorbid conditions also found that uric acid has positive correlation in individuals with higher cognitive and intellectual ability.[9,11] In contrast to these findings, in our study, no statistically significant correlation was obtained between UA and IQ which is in accordance with the finding of Inouye et.al.[5] A complex trait like IQ has multiple determinants and involve genetic components as well as extrinsic factors like diet, environment and upbringing just to name a few.[12–14] Also it is an established fact that Lesch Nyhan syndrome in which there is hyperuricaemia and deficiency of HGPRT enzyme is manifest as mental retardation.[15]

## CONCLUSION

In our study, serum UA level in medical and dental students is found to have no correlation with their IQ.

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