ORIGINAL RESEARCH ARTICLE

Prevalence of Hyperuricemia and Its Risk Factors Among Residents of a Rural Field Practice Area in Belagavi, India

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ABSTRACT

Background: Serum Uric Acid (SUA) is often overlooked in primary healthcare, primarily associated with Gouty Arthritis. However, the literature indicates its links to dyslipidaemia, cardiovascular diseases, hypertension, and metabolic syndrome. This study aimed to determine the prevalence of hyperuricemia and its associated risk factors among rural residents.

Methodology: A cross-sectional study was conducted from January to May 2023, involving 300 individuals aged ≥30 during routine NCD screening. Data on socio-demographics, meat consumption habits, thiazide diuretic usage, and anthropometric measurements were collected. Blood samples were obtained for SUA analysis after informed consent.

Results: Participants had a median age of 45 years, BMI of 25.41 kg/m^2, and SUA level of 5 mg/dl. The study revealed an overall hyperuricemia prevalence of 32.7%. While no significant associations were found between hyperuricemia and the variables analysed, a statistically significant positive linear correlation emerged between SUA levels and waist or hip circumference. Binary logistic regression showed a significant association between hyperuricemia and the frequency of meat consumption.

Conclusion: This study suggests that SUA can serve as a valuable tool in primary healthcare. Identifying and treating individuals with hyperuricemia, and educating those at risk, can help prevent future vascular events.

Keywords: Hyperuricemia, Uric Acid, Prevalence, Risk Factors, Belagavi

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INTRODUCTION

Uric acid (UA) is a heterocyclic compound found in the blood and bodily fluids of humans and other animals. It's a product of the metabolism of purines, which are natural substances found in various foods and cells. Elevated levels of uric acid can lead to a medical condition called hyperuricemia, which is associated with gout, a painful form of arthritis. Additionally, uric acid plays a role in certain diseases like kidney stones and renal disorders.[1]

Research has indicated that elevated levels of uric acid might be associated with an increased risk of developing cardiovascular diseases, such as hypertension, coronary artery disease, and heart failure. The mechanisms underlying this relationship are still being studied, but potential factors include inflammation, oxidative stress, and endothelial dysfunction.[2]

Most of the previous studies on hyperuricemia from India had been conducted in an institutional setting among patients with specific comorbidities and not in the general population. So, this study is very unique and would benefit the population in the study area to create awareness with respect to the deleterious effects of uric acid on cardiovascular health.

By early detection of hyperuricemia at the primary care level, the population at high risk can be educated on the deleterious effect of UA and could be advised on the health promoting behaviour such as making lifestyle modification with respect to avoiding uric acid rich diet particularly beer, wine, liquor, soft drinks, poultry, potatoes and meat products like beef, pork, lamb.[3]

Uric Acid is one of the neglected investigations in a primary health care setting, but owing to the available evidence on the deleterious effects of hyperuricemia, the study was undertaken to estimate the prevalence of hyperuricemia and to determine its associated risk factors among the residents of a rural field practice area.

METHODOLOGY

A community-based cross-sectional study was conducted among 300 residents of a rural field practice area in Belagavi from January to May 2023 over a period of 5 months after obtaining informed consent. Ethical clearance was obtained from JNMC Institutional Ethical Committee vide reference no. MDC/JNMCIEC/170 dated 03.01.2023.

The prevalence of Hyperuricemia in Indian subjects was reported to be 25.3% in the study conducted by Billa et al.[4] Using the formula to estimate sample size in cross-sectional studies ($n=Z^2pq/d^2$) with 5% absolute precision, a sample size of 290 was obtained. It was rounded off to 300 for the study purposes. Consecutive sampling method was adopted and participants fulfilling the inclusion criteria were recruited from Peeranwadi health sub-Centre area of Kinaye PHC during routine NCD screening until the desired sample size was reached.

The study area was found to have an increased incidence of non-communicable diseases in the recent trend. Also, the individuals of the area were found to consume excess of Red Meat which is a risk factor for the development of Hyperuricemia. The cut-off value for Hyperuricemia in this study was considered to be >7 mg/dL in men and >6 mg/dL in women as per the study conducted by Tanriverdi et al. [5] The study included consented individuals of ≥30 years of age from the area and excluded participants who were already on any urate lowering therapy.

Data on their socio-demographic status such as Age, Gender, Religion, Marital Status, Educational Qualification, Occupation, Socio-economic status, Religion, Smoking and Alcohol status were obtained. Also, data on their Hypertension status and Usage of Thiazide Diuretics, Duration and Frequency of Meat Consumption and Anthropometric measures of BMI, Waist: Hip Ratio and S. Uric Acid Levels were assessed.

Statistics: Data were entered in Microsoft Excel and analysed using IBM SPSS Statistics v23.0 and results were tabulated and represented using Descriptive and Inferential statistics. All p-values <0.05 were considered to be significant.

RESULTS

Table 1 depicts the socio-demographic data and their association with Hyperuricemia among the study participants. As the normality tests were not satisfied, the data is represented using Median and Interquartile Range (IQR). The Median (IQR) Age of the participants in our study were 45 (19) years. Most of our study participants were Female (83.7%), Married (96.7%), Unemployed (70.0%), belonging to Socio-Economic Class III (36.3%), Muslim Religion (66.0%) having a Sedentary Lifestyle (66.3%). Also, the data showed that most of them were Obese in terms of BMI (54.3%) as well as Waist: Hip Ratio (73.3%) with a Hyperuricemia prevalence rate of 32.7% among the study participants. With respect to the association, surprisingly our study did not show any association with any of the variables studied even though the strength of association was statistically significant for those consuming meat >3 times a week compared to the reference category. Despite proven association between Hyperuricemia and Usage of Thiazide Diuretics, our study failed to prove it probably because of the limited number of individuals using them as it is not being prescribed as a common first line drug for Hypertension.

Table 2 depicts the Binary Logistic Regression Model used to predict the odds of developing Hyperuricemia developed using the closely associated variables (Frequency of Meat Consumption, Obesity estimated using Waist: Hip Ratio and Employment Status) with p<0.1.

Table 1: Socio-Demographic Data and Association between covariates (n=300) (Continue on next page)

Covariates	n (%)	S. Uric Acid		p-value	Unadjusted Odds Ration	
		High (n = 98) (%)	Normal (n = 202) (%)		OR (95% CI)	p-value
Age [Median (IQR) = 45(19)]						
Age (in years)						
30 - 39	106(35.3)	30 (28.3)	76 (71.7)	0.362	Reference	
40 - 49	71(23.7)	21 (29.6)	50 (70.4)		1.064 (0.549, 2.063)	0.854
50 - 59	61(20.3)	22 (36.1)	39 (63.9)		1.429 (0.730, 2.799)	0.298
> 60	62(20.7)	25 (40.3)	37 (59.7)		1.712 (0.884, 3.313)	0.111
Gender						
Male	49(16.3)	16 (16.3)	33 (16.3)	0.998	Reference	
Female	251(83.7)	82 (83.7)	169(83.3)		1.001 (0.521, 1.922)	0.998
Religion						
Hindu	102(34.0)	31 (31.6)	71 (35.1)	0.547	Reference	
Muslim	198(66.0)	67 (68.4)	131(64.9)		1.171 (0.700, 1.959)	0.547
Marital Status						
Married	290(96.7)	96 (98.0)	194(96.0)	0.385	Reference	
Unmarried	10(3.3)	2 (2.0)	8 (4.0)		0.505 (0.105, 2.425)	0.394
Education						
Illiterate	20(6.7)	6 (6.1)	14 (6.9)	0.239	Reference	
Elementary (1-8)	133(44.3)	47 (48.0)	86 (42.6)		1.275 (0.460, 3.537)	0.641
Secondary (9-12)	115(38.3)	39 (39.8)	76 (37.6)		1.197 (0.427, 3.358)	0.732
Diploma	10(3.3)	4 (4.1)	6 (3.0)		1.556 (0.319, 7.597)	0.585
Bachelor's	15(5.0)	2 (2.0)	13 (6.4)		0.359 (0.061, 2.106)	0.256
Master's	7(2.3)	0 (0.0)	7 (3.5)		0	
Employment Status						
Employed	90(30.0)	23 (23.5)	67 (33.2)	0.086	Reference	
Unemployed	210(70.0)	75 (76.5)	135(66.8)		1.618 (0.932, 2.809)	0.087
Socio-Economic Status						
Class I	26(8.7)	7 (7.1)	19 (9.4)	0.328	Reference	
Class II	79(26.3)	23 (23.5)	56 (27.7)		1.115 (0.413, 3.010)	0.83
Class III	109(36.3)	43 (43.9)	66 (32.7)		1.768 (0.685, 4.563)	0.238
Class IV	68(22.7)	18 (18.4)	50 (24.8)		0.977 (0.352, 2.711)	0.965
Class V	18(6.0)	7 (7.1)	11 (5.4)		1.727 (0.478, 6.238)	0.404
Lifestyle						
Sedentary	199(66.3)	71 (72.4)	128(63.4)	0.268	Reference	
Moderate	92(30.7)	24 (24.5)	68 (33.7)		0.636 (0.368, 1.101)	0.106
Heavy	9(3.0)	3 (3.1)	6 (3.0)		0.901 (0.219, 3.714)	0.886
Type of Family						
Nuclear	192(64.0)	63 (64.3)	129(63.9)	0.958	Reference	
Joint	76(25.3)	24 (24.5)	52 (25.7)		0.945 (0.535, 1.671)	0.846
Three Generation	32(10.7)	11 (11.2)	21 (10.4)		1.073 (0.487, 2.361)	0.862
Duration of Meat Consumption						
<10 years	31(10.3)	9 (9.2)	22 (10.9)	0.325	Reference	
10-20 years	1(0.3)	1 (1.0)	0 (0.0)		-	
>20 years	268(89.3)	88 (89.8)	180(89.1)		1.195 (0.528, 2.704)	0.669
Frequency of Consumption						
>3 times a week	24(8.0)	13 (13.3)	11 (5.4)	0.058	4.018 (1.380, 11.698)	0.011
2-3 times a week	132(44.0)	45 (45.9)	87 (43.1)		1.759 (0.797, 3.881)	0.162
Once in a week	100(33.3)	30 (30.6)	70 (34.7)		1.457 (0.639, 3.324)	0.371
< once/week	44(14.7)	10 (10.2)	34 (16.8)		Reference	
Smoking Status						
Current Smoker	5(1.7)	3 (3.1)	2 (1.0)	0.393	3.177 (0.522, 19.340)	0.21
Past Smoker	5(1.7)	2 (2.0)	3 (1.5)		1.412 (0.232, 8.596)	0.708
Non-smoker	290(96.7)	93 (94.9)	197(97.5)		Reference	
Alcohol Use						
Currently Alcoholic	5(1.7)	2 (2.0)	3 (1.5)	0.333	1.396 (0.230, 8.498)	0.717
Past Alcohol Use	1(0.3)	1 (1.0)	0 (0.0)		-	
Non-Alcoholic	294(98.0)	95 (96.9)	199(98.5)		Reference	
Hypertension						
Yes	69(23.0)	22 (31.9)	47 (68.1)	0.874	0.955 (0.537, 1.698)	0.874
No	231(77.0)	76 (32.9)	155(67.1)		Reference	
Use of Thiazide Diuretics						
Yes	6(2.0)	1 (1.0)	5 (2.5)	0.399	0.406 (0.047, 3.525)	0.414
No	294(98.0)	97 (99.0)	197(97.5)		Reference	

Covariates	n (%)	S. Uric Acid		p-value	Unadjusted Odds Ration	
		High (n = 98) (%)	Normal (n = 202) (%)		OR (95% CI)	p-value
BMI (WHO SE Asian Criteria)						
Underweight	16(5.3)	4 (4.1)	12 (5.9)	0.883	Reference	
Normal	65(21.7)	20 (20.4)	45 (22.3)		1.333 (0.383, 4.645)	0.651
Overweight	56(18.7)	19 (19.4)	37 (18.3)		1.541 (0.437, 5.429)	0.501
Obese	163(54.3)	55 (56.1)	108(53.5)		1.528 (0.471, 4.958)	0.48
Waist Hip Ratio						
Obese	220(73.3)	78 (79.6)	142(70.3)	0.088	1.648 (0.926, 2.933)	0.089
Non-Obese	80(26.7)	20 (20.4)	60 (29.7)		Reference	

*Values within () represent % among the categories, ∞ indicates undefined values

Table 2: Binary Logistic Regression Analysis to predict odds of developing Hyperuricemia

Variables	AOR	95% CI	p-value
Employment Status			
Employed (Unemployed)	0.6	0.34 - 1.059	0.078
Frequency of Meat Consumption		-	
>3 times a week (<once/week)	4.609	1.546 - 13.738	0.006
2-3 times a week (<once/week)	1.801	0.81 - 4.003	0.149
Once in a week (<once/week)	1.553	0.675 - 3.574	0.301
Waist Hip Ratio		-	
Obese (non-obese)	1.618	0.897 - 2.918	0.11

*Constant (B) = - 1.485 (p = 0.001), *Values within () represent the reference categories

Table 3: Correlation of S. Uric Acid with BMI, Waist & Hip Circumference (n=300)

Variable	Correlation Coefficient (r)	p-value
Waist Circumference	0.129	0.026
Hip Circumference	0.183	0.001
BMI	0.075	0.195

Reference category for comparison was the least preferred variables such as Unemployed for Employment Status, <once/week for Frequency of Meat Consumption and Non-obese for Waist: Hip Ratio. Interestingly, the model showed a statistical significance between Hyperuricemia and consumption of Meat >3 times a week compared to those consuming <once/week with a p<0.01. The goodness of fit for the model was proved using Hosmer and Lameshow Test (p=0.813), rejecting the null hypothesis with a -2 Log Likelihood value of 365.362 and Nagelkerke R Square Value of 0.062.

Table 3 depicts the linear correlation analysis of S. Uric Acid values with BMI, Waist and Hip Circumferences. The results showed that there a was a positive linear correlation between Waist Circumference (Figure 1), Hip Circumference (Figure 2) and S. Uric Acid values with p<0.05. However, a similar observation was not observed with BMI (Fig 3) in our study.

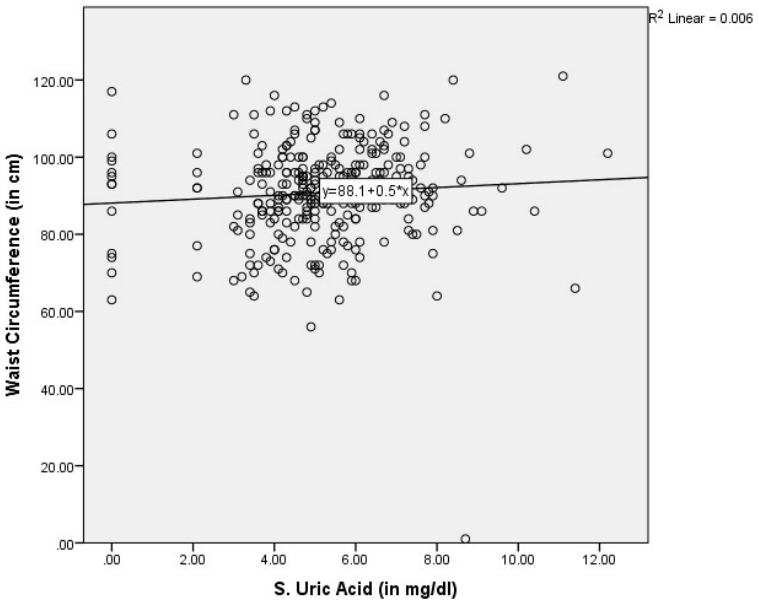

Figure 1: Correlation between S. Uric Acid & Waist Circumference

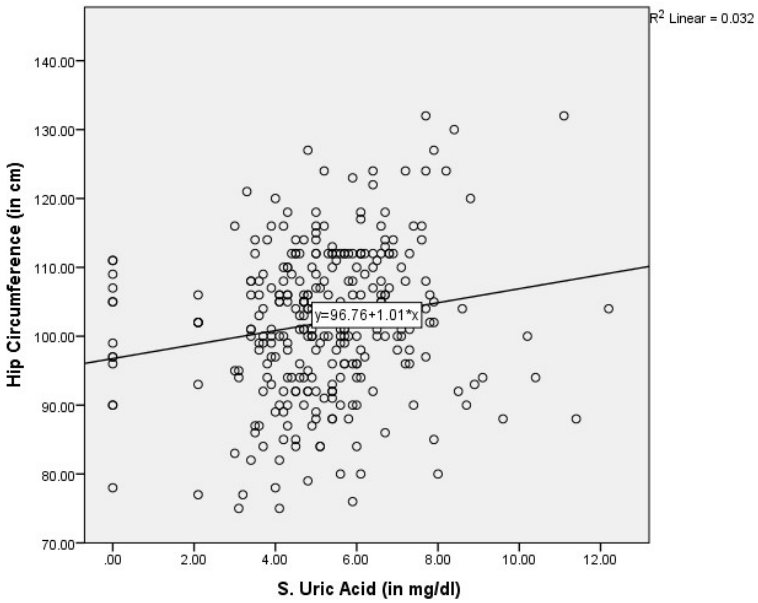

Figure 2: Correlation between S. Uric Acid & Hip Circumference

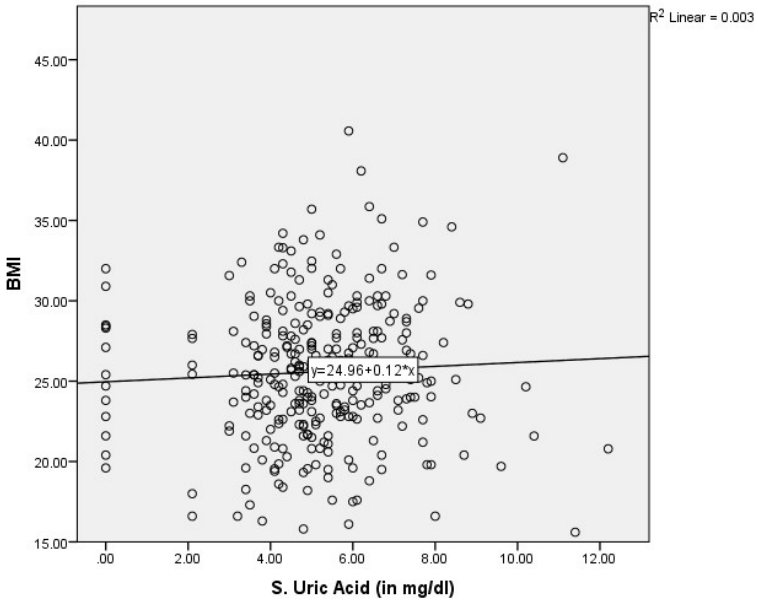

Figure 3: Correlation between S. Uric Acid & BMI

DISCUSSION

Our study found a prevalence of 32.7% of Hyperuricemia in the study area. A similar prevalence (30.1%) was reported in the study conducted by Raja et al[6] among the general population in Karachi, Pakistan. Such prevalence studies were also carried out in several other countries.[7–13] However, the prevalence varies when estimated in an institutional setting[14] or in those with other pre-existing co-morbidities[15–18] as reported by Singh et al[15] in their study conducted among new onset diabetic patients presenting to a tertiary care center and in fact much lesser (12.13%) when compared to the ones obtained from the community. Whereas, retrospective studies conducted by Patel et al[16] and Billa et al[4] among Diabetic hypertensives were 29.85% and 34.4% respectively. This could be either due to the pre-existing co-morbidities or the fact that the patients might already be consuming certain medications which are prone to cause hyperuricemia. Moreover, the risk factors for hypertension and diabetes are almost the same as that for hyperuricemia like obesity.

Moreover, the prevalence of hyperuricemia can vary according to the age, gender[19] and geography.[20] But, our study did not find any difference between hyperuricemia prevalence among men and women. However, Abujbara et al[21] reported a prevalence of 28.1% among T2DM Patients in Jordan whereas Ali et al[22] reported a prevalence of 9.3% in their study con-

ducted among staffs and students of a medical college in Bangladesh which could be due to the modern lifestyle and the influence of certain cultural factors like regular consumption of meat and intake of alcohol.

Our study found no association between hyperuricemia and any of the variables analysed. However, the studies done by Hu et al[23] and Mundhe et al[24] had reported an association of hyperuricemia with metabolic syndrome and insulin resistance whereas Raja et al[25] reported an association of hyperuricemia with patient characteristics including gender, hypertension, use of thiazide diuretics, frequency of meat consumption, sedentary lifestyle, and BMI. This is primarily because of the consumption of purine rich foods which by itself has the potential to cause hyperuricemia as discussed earlier. The disparity observed in our study may be attributed to the utilization of community-based purposive sampling, which predominantly included participants who were not afflicted with diabetes or hypertension. But this approach was chosen to ascertain a genuine assessment of the prevalence of hyperuricemia in the community.

Since, our study had certain closely associated variables (with $p<0.1$) such as employment and frequency of meat consumption, a multiple logistic regression analysis was applied to evaluate the association in comparison to the reference categories, where we found a higher prevalence of hyperuricemia among those consuming meat >3 times a week than those consuming <1 time a week that was statistically significant. A similar finding was also reported in the study conducted by Raja et al.[25]

Our study also found a positive linear correlation between serum uric acid levels and waist, hip circumferences independently that was statistically significant. A similar finding was also reported in the study conducted by Ali et al[26] in addition to a positive linear correlation between BMI and serum uric acid levels.

Since, the previous studies conducted in India were among the patients especially in a tertiary care setting, this study is one of its kind and unique as far as primary healthcare is concerned. As the study was conducted with an adequate sample size, the results can be generalized up to certain extent to the population covered under Kinaye PHC. However, there can be certain limitations to the study especially because of its cross-sectional design and a potential measurement bias that could have occurred during anthropometric measures and sample analysis.

Conclusion

In light of its increasing prevalence within the community, hyperuricemia emerges as a crucial indicator necessitating investigation at the primary healthcare level. Also, recognizing and addressing hyperuricemia, especially among those with obesity and frequent meat consumption, is crucial in averting the onset of future vascular events. Owing to its descriptive nature, the study may pose certain limitations that could be mitigated in future research through the implementation of an analytical design.

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