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# COMPARATIVE ASSESSMENT OF NUTRIENT INTAKE OF URBAN AND RURAL ADULTS WITH SPECIAL REFERENCE TO CALCIUM, OXALATE AND PHOSPHORUS

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## ABSTRACT

Calcium oxalate is the major component of about 75% of all urinary stones. Diet has a key role in determining urinary chemistry and can influence the stone formation. The nutritional risk factors include an inadequate intake of fluids or excessive intake of foods rich in oxalate, sodium and calcium. Diet influence urinary constituents and pH, which may affect stone nucleation and growth. The objective of calculation of calcium, oxalate, and phosphate intake in adults of urban and rural areas of Varanasi district. A community based crossectional study was undertaken on 304 adults (Urban 152, Rural 152), 18-60 years of age group. A pretested and predesigned questionnaire was used to collect the information for the study. Socioeconomic and demographic information of study subject was assessed by interview technique. Dietary intake of study subjects was assessed by 24 Hours dietary recall methods. The nutrients calcium, oxalate and phosphate were estimated by using Nutritive value of Indian Foods. It may be concluded that in both the studied community majority of the respondents belong to 31-45 years of age group while the percentage of male was higher than female in urban and it was just reverse in rural community. Rural subjects have significantly, and low socioeconomic status as compare to urban subjects. The mean calcium intake is found to be more among rural male and females than urban male and females respectively but difference is not significant. The mean oxalate intake is insignificantly higher among rural males than urban but among females it was significantly higher in urban community in comparison to rural. It is seen that the proportion of male and female subjects belong to rural area consuming less than RDA of phosphorus is more than the urban male and female subjects respectively & the differences is significant.

**Key words:** Adult, Stone disease, Calcium, Oxalate, Phosphate, Recommended Dietary Allowance.

## INTRODUCTION

Stone disease is a multi-factorial disorder resulting from the combined influence of epidemiological, biochemical and genetic risk factors. Modern lifestyle changes, sedentary habits, lack of easiness, an unhealthy dietary plan, and overweight problems of the affluent societies-emerge to be the important promoters of the "stone-boom" in the new millennium both in developed and underdeveloped countries. Major risk factors that contribute to stone formation and its recurrence include “classic” risk factors in the urine (low urine volume, hypercalciuria, hyperoxaluria, hyperuricosuria, hypocitrauria, and hypomanesuria), epidemiological factors - climate, race, ethnicity, age, sex, body weight. Factors such as age, sex, ethnic and geographic distribution determines prevalence. The prevalence of calculi ranges from 4 to 20 percent (Hussain et al 1996). Curhan et al (1997) demonstrated that men have higher oxalate concentrations than in women. Calcium intake, particularly through milk and dairy products, may be associated with hypercalciuria and stone formation. However, inverse relationships between dietary calcium and stone formation have been demonstrated, in that groups of men and women with the highest calcium intake have been shown to have nearly one half the rate of stones as groups with the lowest intake (Curhan et al 1993, 1997). Dietary calcium binds in the intestinal lumen with dietary oxalate, forming an insoluble, non-absorbable complex. The reduction in urinary oxalate levels that occurs with increased intake of dietary calcium is proportionally more important than the increased urinary calcium levels. Like oxalate, some dietary calcium may also be less bioavailable. (Curhan et al 1997).Stone is formed usually due to deposition of calcium, phosphates and oxalates which are a major health hazards.

Diet has a key role in determining urinary chemistry and can influence the stone formation. The nutritional risk factors include an inadequate intake of fluids or excessive intake of foods rich in oxalate, sodium and calcium. Diet influence urinary constituents and pH, which may affect stone nucleation and growth (P.S.Viayabharathi & M. Amirthaveni 2008). A better understanding of the relationship between diet (rich in calcium, oxalate, and phosphate) and the risk of calculus

formation will have the potential to provide simpler and most cost effective measures of prevention of stone disease. Hence the present study was carried out with the objective of calculation of calcium, oxalate, and phosphate intake in adults of urban and rural areas of Varanasi district.

## METHODOLOGY

### STUDY DESIGN

A community based cross sectional design was adopted for this study.

### STUDY SAMPLE

Male and female adult's age group 18-60 were considered for this study.

### SAMPLE SIZE

The sample size is calculated on the basis of knowledge regarding calcium, phosphate and oxalate which are major constituent of stone formation in urban as well as rural adults. The proportion of adults had knowledge about stone constituent is decided after pilot survey in urban as well as rural community which comes out 40% and 25% respectively. The determination of sample size is fixed considering 1:1 ratio between urban and rural adults, level of significance at 5% ($\alpha = 0.05$) and 80% of power of test $(1-\beta)=0.80$ therefore after computing sample size come 304 which is decided into two equal part. Therefore 152 adults from rural as well as 152 adults from urban were selected.

### SAMPLING METHODOLOGY

Varanasi district has been divided into 8 blocks (namely Cholapur, Chiraigaon, Kashi Vidyapieth, Harahua, Baragaon, Pindra, Sivapur and Arazi Line) and 90 wards. Among 8 blocks Kashi Vidyapeeth block has been selected randomly and in 90 wards Nariya ward has been selected randomly. In Kashi Vidyapeeth block there are 122 villages and among these villages Susuwahi and Madhopur villages has been selected randomly. In Nariya ward, Saket Nagar,& Bhogabeer areas were included in the study . A door to door survey was conducted and only one male or female adult was selected from each household alternatively until the sample size has been attained.

### TOOLS OF STUDY

Pretested and predesigned questionnaire was used for this study.

### TECHNIQUE OF THE STUDY

The adults was personally informed the purpose of the study and their consent obtained prior to data collection. Socioeconomic and demographic information of study subject was assessed by interview technique. Dietary intake of study subjects was assessed by 24 Hours dietary recall methods. The nutrients calcium, oxalate and phosphate were estimated by using Nutritive value of Indian Foods (Gopalan et al 1989).

### ANALYSIS OF DATA

Data thus generated was analysed with the help of Microsoft excel 2007 and SPSS version 16th software. Appropriate table were generated, statistical test $\chi^2$ ,F test ,post hock and t, test applied.

## RESULT AND DICUSSION

**Table No. 1 : Region wise distribution of respondents according to their sex and socioeconomic status.**

| Age (years) | Region | | | | Total (304) | |
|---|---|---|---|---|---|---|
| | Urban (152) | | Rural (152) | | | |
| | No. | % | No. | % | No. | % |
| ≤ 30 | 56 | 36.8 | 42 | 27.6 | 98 | 32.2 |
| 31 – 45 | 55 | 36.2 | 72 | 47.4 | 127 | 41.8 |
| > 45 | 41 | 27.0 | 38 | 25.0 | 79 | 26.0 |
| **Total** | **152** | **100.0** | **152** | **100.0** | **304** | **100.0** |
| **Average Age± SD** | **38.01 ±12.51** | | **38.74 ±11.43** | | **38.38 ±11.97** | |
| **t = 0.53, df = 302, p >0.05** | | | | | | |

| **Sex** | **No.** | **%** | **No.** | **%** | **No.** | **%** |
|---|---|---|---|---|---|---|
| Male | 90 | 59.2 | 61 | 40.1 | 151 | 49.7 |
| Female | 62 | 40.8 | 91 | 59.9 | 153 | 50.3 |
| **$\chi^2$ = 11.07, df = 1, p <0.01** | | | | | | |

**Socio-economic status**

| | | | | | | |
|---|---|---|---|---|---|---|
| Low | 20 | 13.2 | 54 | 35.5 | 74 | 24.3 |
| Medium | 60 | 39.5 | 76 | 50.0 | 136 | 44.7 |
| High | 72 | 47.4 | 22 | 14.5 | 94 | 30.9 |
| **Total** | **152** | **100.0** | **152** | **100.0** | **304** | **100.0** |
| **$\chi^2$ = 44.10, df = 2, p <0.001** | | | | | | |

Table 1 depicts that majority of respondents (41.8%) were from the age group 31-45 yrs, followed by younger age group in both type of localities. The average age is (38.01 ± 12.51) in urban respondents and it is (38.74 ± 11.43) in rural but statistically, this difference is not significant. In urban community, male respondents

(59.2%) were selected in more proportion than the rural male respondents (40.1%) whereas it was just in reverse proportion in female respondents. The difference in proportion of male and female respondent between urban and rural community is found to be statistically significant. In urban community, majority of respondents 47.4% belong to high socio-economic status followed by 39.5% to medium socio-economic status whereas in rural area 50.0% and 35.5% belong to medium and low socio-economic status respectively. The difference in proportion in connection to educational status, occupational status, type of work as well as various socio-economic statuses between urban and rural areas is statistically highly significant.

**Table No. 2 : Region wise Distribution of subjects on the basis of percentage of calcium intake with respect to RDA**

| Sex | Calcium of RDA % | Region | | | | | |
|---|---|---|---|---|---|---|---|
| | | Urban | | Rural | | Total | |
| | | No. | % | No. | % | No. | % |
| Male | ≤80 | 28 | 31.1 | 25 | 41.0 | 53 | 35.1 |
| | 80 – 100 | 33 | 36.7 | 14 | 23.0 | 47 | 31.1 |
| | > 100 | 29 | 32.2 | 29 | 36.1 | 51 | 33.8 |
| **Total** | | **90** | **100.0** | **61** | **100.0** | **151** | **100.0** |
| **$\chi^2$ = 3.37, df = 2, p >0.05** | | | | | | | |
| Female | ≤80 | 33 | 53.2 | 42 | 46.2 | 75 | 49.0 |
| | 80 – 100 | 18 | 29.0 | 25 | 27.5 | 43 | 28.1 |
| | > 100 | 11 | 17.7 | 24 | 26.4 | 35 | 22.9 |
| **Total** | | **62** | **100.0** | **91** | **100.0** | **153** | **100.0** |
| **$\chi^2$ = 1.61, df = 2, p >0.05** | | | | | | | |
| Total | ≤80 | 61 | 40.1 | 67 | 44.1 | 128 | 42.1 |
| | 80 – 100 | 51 | 33.6 | 39 | 25.7 | 90 | 29.6 |
| | > 100 | 40 | 26.3 | 46 | 30.3 | 86 | 28.3 |
| **Total** | | **152** | **100.0** | **152** | **100.0** | **304** | **100.0** |
| **$\chi^2$ = 2.30, df = 2, p >0.05** | | | | | | | |

Out of total male subjects 35.1% consumed less than 80% calcium of RDA while 33.8% above RDA but in urban male subjects it was 31.1% and 32.2% and in rural areas it was 41.0% and 36.1% respectively. There is no significant difference in proportion between urban and rural subjects in connection to calcium intake of RDA. It is observed that more than half 53.2% of urban females took calcium less than 80% of RDA followed by 29.0% in range of (80-100)% and minimum 17.7% more than RDA while less than 80% of RDA of calcium intake was observed 46.2%, (80-100)% in 27.5% and remaining 26.4% more than RDA in rural females. In this case also the difference is not statistically significant. *Amare B.* et al (2012) found in his study that 90.4%, respondents have inadequate intakes of calcium.

**Table No. 3: Region wise Distribution of average calcium intake (in mg) between male and female respondents.**

| Sex | Region | | | Statistics | | |
|---|---|---|---|---|---|---|
| | Urban | Rural | Total | t | df | p |
| | Mean ± SD | Mean ± SD | Mean ± SD | | | |
| Male | 609.04 ± 219.80 | 621.82 ± 299.22 | 614.21 ± 254.01 | 0.30 | 149 | >0.05 |
| Female | 517.56 ± 176.79 | 529.56 ± 201.91 | 524.70 ± 191.61 | 0.38 | 151 | >0.05 |
| **Total** | **571.73 ± 207.69** | **566.59 ± 248.86** | **569.16 ± 228.84** | **0.20** | **302** | **>0.05** |
| | **t = 2.73 df = 150 p<0.01** | **t = 2.27 df = 150 p<0.05** | **t = 3.47 df = 302 p<0.01** | | | |

The average calcium intake was found to be 609.04 mg in urban and 621.82 mg in rural males which are higher than females of urban (517.56) mg and rural (529.56) mg respectively and this difference between male and females is found to be statistically highly significant in both areas . It is also seen that there is no significant difference in average consumption of calcium between urban and rural area among male, female as well as for both together while Harinarayan et al (2007) have reported in his study that urban male and female respondents have higher calcium intake than the rural.

**Table No. 4: Region wise distribution of male respondents on the basis of calcium intake (in mg) in relation to different type of specified variable.**

| Variability | Region | | | Statistics | | |
|---|---|---|---|---|---|---|
| | Urban | Rural | Total | t | df | p |
| | Mean ± SD | Mean ± SD | Mean ± SD | | | |
| **Age** | | | | | | |
| ≤ 30 | 596.54 ± 208.88 | 558.91 ± 273.77 | 582.60 ± 233.18 | 0.57 | 52 | >0.05 |
| 31 – 45 | 634.24 ± 245.34 | 614.17 ± 283.13 | 624.75 ± 261.58 | 0.28 | 53 | >0.05 |
| > 45 | 597.73 ± 210.08 | 718.97 ± 350.69 | 641.03 ± 270.99 | 1.41 | 40 | >0.05 |
| **Total** | **609.04 ± 219.80** | **621.82 ± 299.22** | **614.21 ± 254.01** | | | |
| | **F = 0.28 p>0.05** | **F =1.25 p>0.05** | **F = 0.70 p>0.05** | | | |
| **Family Type** | | | | | | |
| Joint | 620.10 ± 247.62 | 525.28 ± 259.38 | 576.85 ± 255.25 | 1.41 | 55 | >0.05 |
| Nuclear | 603.23 ± 205.72 | 693.54 ± 310.02 | 636.86 ± 251.91 | 1.70 | 92 | >0.05 |
| | **t = 0.35 df = 88 p >0.05** | **t = 2.25 df = 59 p<0.05** | **t = 1.41 df = 149 p>0.05** | | | |
| **Type of work** | | | | | | |
| Sedentary | 672.65 ± 211.24 | 610.78 ± 337.07 | 653.94 ± 253.18 | 0.73 | 41 | >0.05 |
| Moderate | 582.48 ± 230.30 | 618.50 ± 300.40 | 596.54 ± 258.71 | 0.61 | 80 | >0.05 |
| Heavy | 551.04 ± 155.16 | 637.49 ± 283.48 | 604.24 ± 242.33 | 0.88 | 24 | >0.05 |
| | **F = 2.02 p>0.05** | **F = 0.03 p >0.05** | **F = 0.74 P >0.05** | | | |
| **SES** | | | | | | |
| Low | 482.52 ± 133.96 | 652.65 ± 280.43 | 577.80 ± 239.80 | 1.85 | 23 | >0.05 |
| Medium | 570.26 ± 187.47 | 609.36 ± 294.45 | 591.80 ± 251.13 | 0.64 | 67 | >0.05 |
| High | 663.09 ± 239.82 | 626.49 ± 374.55 | 657.31 ± 261.71 | 0.38 | 55 | >0.05 |
| | **F = 4.01 p <0.05** | **F = 0.11 p>0.05** | **F = 1.35 p>0.05** | | | |
| | **Sign.pairs 1vs 3** | | | | | |
| **Education** | | | | | | |
| Low | 511.20 ± 184.19 | 671.24 ± 287.30 | 620.03 ± 265.95 | 1.44 | 23 | >0.05 |
| Medium | 616.03 ± 236.99 | 555.89 ± 301.06 | 588.42 ± 261.68 | 0.87 | 59 | >0.05 |
| High | 620.31 ± 213.15 | 684.72 ± 303.05 | 636.17 ± 237.44 | 0.94 | 63 | >0.05 |
| | **F = 0.87 p >0.05** | **F = 1.28 p>0.05** | **F = 0.56 p>0.05** | | | |
| **Income** | | | | | | |
| ≤ 1000 | 538.26 ± 163.33 | 696.45 ± 235.71 | 617.36 ± 214.67 | 2.06 | 26 | <0.05 |
| 1000 – 2500 | 577.64 ± 241.95 | 590.06 ± 302.90 | 584.27 ± 273.92 | 0.18 | 58 | >0.05 |
| >2500 | 648.01 ± 216.44 | 619.93 ± 347.98 | 641.32 ± 251.00 | 0.38 | 61 | >0.05 |
| | **F = 1.80 p>0.05** | **F = 0.61 p>0.05** | **F = 0.78 p>0.05** | | | |

It is also observed that there is no significant difference in average calcium intake between urban and rural males in various group of age, family type, type of work, SES, educational status and monthly per capita income with the exception of only below poverty line.

**Table No. 5: Region wise distribution of female respondents on the basis of calcium intake (in mg) in relation to different types of specified variable**

| Variability | Region | | | Statistics | | |
|---|---|---|---|---|---|---|
| | Urban | Rural | Total | t | df | p |
| | Mean ± SD | Mean ± SD | Mean ± SD | | | |
| **Age** | | | | | | |
| ≤ 30 | 506.31 ± 195.92 | 554.48 ± 234.82 | 530.40 ± 215.10 | 0.74 | 42 | >0.05 |
| 31 – 45 | 494.56 ± 132.48 | 528.83 ± 188.15 | 516.45 ± 169.97 | 0.82 | 70 | >0.05 |
| > 45 | 577.95 ± 213.78 | 507.19 ± 201.44 | 533.96 ± 206.18 | 1.01 | 35 | >0.05 |
| **Total** | **517.56 ± 176.79** | **529.56 ± 201.90** | **524.70 ± 191.61** | | | |
| | **F = 1.08 p>0.05** | **F =0.31 p>0.05** | **F = 0.13 p>0.05** | | | |
| **Family Type** | | | | | | |
| Joint | 559.40 ± 196.20 | 519.51 ± 203.92 | 533.01 ± 200.70 | 0.76 | 63 | >0.05 |
| Nuclear | 494.54 ± 163.18 | 538.56 ± 201.81 | 518.55 ± 185.54 | 1.11 | 86 | >0.05 |
| | **t = 1.39 df = 60 p >0.05** | **t = 0.45 df = 89 p>0.05** | **t = 0.46 df = 151 p>0.05** | | | |
| **Type of work** | | | | | | |
| Sedentary | 529.33 ± 168.37 | 533.38 ± 214.14 | 531.76 ± 196.26 | 0.11 | 103 | >0.05 |
| Moderate | 504.56 ± 201.83 | 516.83 ± 166.15 | 511.02 ± 181.47 | 0.21 | 36 | >0.05 |
| Heavy | 387.35 ± 94.96 | 531.28 ± 206.00 | 502.49 ± 194.14 | 0.93 | 8 | >0.05 |
| | **F = 0.68 p>0.05** | **F = 0.06 p >0.05** | **F = 0.23 P >0.05** | | | |
| **SES** | | | | | | |
| Low | 552.38 ± 230.53 | 529.77 ± 193.42 | 533.92 ± 198.33 | 0.31 | 47 | >0.05 |
| Medium | 534.82 ± 179.97 | 487.78 ± 186.02 | 508.14 ± 183.55 | 1.04 | 65 | >0.05 |
| High | 483.64 ± 151.42 | 651.07 ± 236.51 | 542.47 ± 199.64 | 2.63 | 35 | <0.05 |
| | **F = 0.75 p >0.05** | **F = 3.33 p<0.05** | **F = 0.46 p>0.05** | | | |
| | | **Sign.pairs 2 vs 3** | | | | |
| **Education** | | | | | | |
| Low | 547.62 ± 197.35 | 524.20 ± 177.89 | 529.29 ± 181.05 | 0.44 | 67 | >0.05 |
| Medium | 501.63 ± 147.83 | 560.98 ± 248.63 | 537.76 ± 214.95 | 0.91 | 44 | >0.05 |
| High | 511.89 ± 186.20 | 463.97 ± 178.43 | 500.54 ± 183.16 | 0.68 | 36 | >0.05 |
| | **F = 0.30 p >0.05** | **F = 0.83 p>0.05** | **F = 0.43 p>0.05** | | | |
| **Income** | | | | | | |
| ≤ 1000 | 529.98 ± 195.49 | 532.91 ± 167.35 | 532.21 ± 172.67 | 0.06 | 57 | >0.05 |
| 1000 – 2500 | 543.89 ± 197.06 | 491.89 ± 233.36 | 513.48 ± 218.56 | 0.85 | 51 | >0.05 |
| >2500 | 488.59 ± 148.99 | 597.37 ± 221.90 | 528.38 ± 184.18 | 1.88 | 39 | >0.05 |
| | **F = 0.62 p>0.05** | **F = 1.41 p>0.05** | **F = 0.14 p>0.05** | | | |

Table 5 reveals that the average consumption of calcium in rural females was found to be higher among various category of age, family type, work type, SES, educational status and monthly per capita income with the exception of higher age group, joint type of family, low and medium SES ,low and high educational status and monthly per capita income Rs.(1000-2500) respectively. There is no significant difference in average calcium intake between urban and rural females among different status of specified variables except high SES.

**Table No. 6 : Region wise distribution of average oxalate intake( in mg) between male and female respondents.**

| Sex | Region | | | Statistics | | |
|---|---|---|---|---|---|---|
| | Urban | Rural | Total | t | df | p |
| | Mean ± SD | Mean ± SD | Mean ± SD | | | |
| Male | 111.20 ± 52.02 | 115.75 ± 58.31 | 113.03 ± 54.50 | 0.50 | 149 | >0.05 |
| Female | 111.58 ± 85.62 | 82.61 ± 37.11 | 94.35 ± 62.93 | 2.86 | 151 | <0.01 |
| **Total** | **111.35 ± 67.50** | **95.91 ± 49.37** | **103.63 ± 59.54** | **2.28** | **302** | **<0.05** |
| | **t = 0.03 df=150 p>0.05** | **t=4.28 df=150 p<0.001** | **t = 2.77 df=302 p<0.01** | | | |

The average consumption of oxalate was found to be 111.20 mg among males and little higher 111.58 mg among females in urban community and a just reverse trend in average intake of oxalate is observed in rural i.e. maximum 115.75 mg among males and minimum 82.61 mg among females. There is a significant difference observed between male and female subjects in rural area only. It is also found that the average intake of oxalate is significantly higher in urban than rural females (Table 6). *Eric N. Taylor and Gary C. Curhan* (2007) has opined in his study that Mean oxalate intakes were higher 214 mg/d in men, than (183 mg/d) in women.

**Table No. 7 : Region wise distribution of male respondents on the basis of the oxalate intake (in mg) in relation to different specified variables.**

| Variability | Region | | | Statistics | | |
|---|---|---|---|---|---|---|
| | Urban | Rural | Total | t | df | p |
| | Mean ± SD | Mean ± SD | Mean ± SD | | | |
| **Age** | | | | | | |
| ≤ 30 | 100.50 ± 47.41 | 104.23 ± 60.57 | 101.88 ± 52.14 | 0.25 | 52 | >0.05 |
| 31 – 45 | 121.71 ± 56.30 | 123.04 ± 54.30 | 122.34 ± 54.86 | 0.09 | 53 | >0.05 |
| > 45 | 113.37 ± 52.12 | 118.46 ± 63.49 | 115.19 ± 55.72 | 0.28 | 40 | >0.05 |
| **Total** | **111.20 ± 52.02** | **115.75 ± 58.31** | **113.03 ± 54.50** | | | |
| | **F = 1.35 p>0.05** | **F =0.60 p>0.05** | **F = 1.99 p>0.05** | | | |
| **Family Type** | | | | | | |
| Joint | 120.15 ± 55.69 | 116.59 ± 89.35 | 118.53 ± 56.89 | 0.23 | 55 | >0.05 |
| Nuclear | 106.49 ± 49.82 | 115.12 ± 58.38 | 109.70 ± 53.03 | 0.76 | 92 | >0.05 |
| | **t = 1.19 df = 88 p >0.05** | **t = 0.10 df = 59 p>0.05** | **t = 0.96 df = 149 p>0.05** | | | |
| **Type of work** | | | | | | |
| Sedentary | 124.86 ± 56.30 | 115.28 ± 62.44 | 121.96 ± 57.64 | 0.50 | 41 | >0.05 |
| Moderate | 106.13 ± 51.44 | 121.80 ± 60.00 | 112.25 ± 55.11 | 1.26 | 80 | >0.05 |
| Heavy | 95.53 ± 33.18 | 104.02 ± 53.06 | 100.76 ± 45.86 | 0.45 | 24 | >0.05 |
| | **F = 1.76 p>0.05** | **F = 0.49 p >0.05** | **F = 1.25 P >0.05** | | | |
| **SES** | | | | | | |
| Low | 90.00 ± 33.21 | 101.79 ± 47.97 | 96.60 ± 41.73 | 0.50 | 41 | >0.05 |
| Medium | 112.16 ± 57.10 | 128.07 ± 65.07 | 120.92 ± 61.69 | 1.26 | 80 | >0.05 |
| High | 115.43 ± 51.80 | 85.44 ± 9.04 | 110.70 ± 48.84 | 0.45 | 24 | >0.05 |
| | **F = 1.08 p >0.05** | **F = 2.60 p>0.05** | **F = 1.94 p>0.05** | | | |
| **Education** | | | | | | |
| Low | 123.56 ± 71.35 | 111.98 ± 52.34 | 115.69 ± 57.81 | 0.69 | 23 | >0.05 |
| Medium | 100.80 ± 46.68 | 115.19 ± 62.23 | 107.40 ± 54.38 | 1.07 | 67 | >0.05 |
| High | 116.18 ± 51.99 | 120.74 ± 60.52 | 117.30 ± 53.71 | 1.72 | 55 | >0.05 |
| | **F = 1.11 p >0.05** | **F = 0.09 p>0.05** | **F = 0.55 p>0.05** | | | |
| **Income** | | | | | | |
| ≤ 1000 | 79.38 ± 22.07 | 120.51 ± 70.86 | 99.95 ± 55.59 | 2.07 | 26 | <0.05 |
| 1000 – 2500 | 115.96 ± 60.14 | 112.40 ± 54.53 | 114.06 ± 56.75 | 0.24 | 58 | >0.05 |
| >2500 | 117.70 ± 50.52 | 118.45 ± 57.18 | 117.87 ± 51.71 | 0.06 | 61 | >0.05 |
| | **F = 3.27 p<0.05 Sign.pairs 1 vs 2,3** | **F = 0.11 p>0.05** | **F = 1.07 p>0.05** | | | |

It is observed that the average consumption of oxalate in rural males is found to be higher as compare to the urban males among various level of specified variables with the exception of joint type of family, sedentary work, having high SES, low educational status and medium economic status but no significant difference is observed in average oxalate intake between urban and rural males except below poverty line (Table 7).

**Table No. 8 : Region wise Distribution of female respondents on the basis of the oxalate intake (in mg) in relation to different specified variables**

| Variability | Region | | | Statistics | | |
|---|---|---|---|---|---|---|
| | Urban | Rural | Total | t | df | p |
| | Mean ± SD | Mean ± SD | Mean ± SD | | | |
| **Age** | | | | | | |
| ≤ 30 | 94.30 ± 76.16 | 83.54 ± 38.74 | 88.92 ± 59.96 | 0.59 | 42 | >0.05 |
| 31 – 45 | 129.26 ± 103.33 | 84.36 ± 39.45 | 100.57 ± 72.23 | 2.64 | 70 | <0.01 |
| > 45 | 105.89 ± 57.68 | 78.22 ± 31.47 | 88.69 ± 44.63 | 1.89 | 35 | >0.05 |
| **Total** | **111.58 ± 85.62** | **82.61 ± 37.11** | **94.35 ± 62.93** | | | |
| | **F = 1.03 p>0.05** | **F =0.22 p>0.05** | **F = 0.66 p>0.05** | | | |
| **Family Type** | | | | | | |
| Joint | 106.04 ± 73.76 | 80.35 ± 34.57 | 89.05 ± 52.15 | 1.92 | 63 | >0.05 |
| Nuclear | 114.63 ± 92.24 | 84.63 ± 39.50 | 98.26 ± 69.87 | 2.04 | 86 | <0.05 |
| | **t = 0.38 df = 66 p >0.05** | **t = 0.56 df = 89 p>0.05** | **t = 0.90 df = 151 p>0.05** | | | |
| **Type of work** | | | | | | |
| Sedentary | 114.50 ± 83.90 | 83.69 ± 38.61 | 96.02 ± 62.40 | 2.54 | 103 | <0.05 |
| Moderate | 109.78 ± 95.18 | 75.94 ± 30.62 | 91.97 ± 70.26 | 1.51 | 36 | >0.05 |
| Heavy | 66.40 ± 0.85 | 90.74 ± 41.70 | 55.87 ± 38.18 | 0.79 | 8 | >0.05 |
| | **F = 0.30 p>0.05** | **F = 0.54 p >0.05** | **F = 0.16 P >0.05** | | | |
| **SES** | | | | | | |
| Low | 104.97 ± 100.06 | 75.70 ± 24.08 | 81.07 ± 47.65 | 1.70 | 47 | >0.05 |
| Medium | 118.11 ± 87.66 | 83.78 ± 36.88 | 98.64 ± 65.69 | 2.18 | 65 | <0.05 |
| High | 106.16 ± 80.64 | 100.45 ± 61.15 | 104.16 ± 73.54 | 0.22 | 35 | >0.05 |
| | **F = 0.16 p >0.05** | **F = 2.28 p>0.05** | **F = 1.71 p>0.05** | | | |
| **Education** | | | | | | |
| Low | 103.70 ± 82.44 | 78.32 ± 29.09 | 83.84 ± 46.58 | 1.90 | 67 | >0.05 |
| Medium | 113.17 ± 72.53 | 91.92 ± 48.91 | 100.23 ± 59.46 | 1.19 | 44 | >0.05 |
| High | 114.67 ± 96.58 | 79.36 ± 37.06 | 106.31 ± 87.11 | 1.06 | 36 | >0.05 |
| | **F = 0.08 p >0.05** | **F = 1.28 p>0.05** | **F = 1.87 p>0.05** | | | |
| **Income** | | | | | | |
| ≤ 1000 | 131.35 ± 123.25 | 77.97 ± 29.03 | 90.64 ± 67.59 | 2.72 | 57 | <0.01 |
| 1000 – 2500 | 96.89 ± 38.45 | 80.00 ± 33.55 | 87.01 ± 36.29 | 1.70 | 51 | >0.05 |
| >2500 | 113.37 ± 91.28 | 101.92 ± 57.51 | 109.18 ± 79.98 | 0.44 | 39 | >0.05 |
| | **F = 0.70 p>0.05** | **F = 2.55 p>0.05** | **F = 1.62 p>0.05** | | | |

Table (8) The mean oxalate intake among females of various group of specified variables in urban areas was found to be higher as compare to the females of rural community except the females doing heavy work but

significant difference is observed only among 31-45 years of age group, nuclear family, engaged in sedentary type of work, had medium SES and below poverty line respectively.

**Table No. 9 : Region wise Distribution of subject on the basis of percentage of phosphorus intake with respect to RDA**

| Sex | of RDA % | Region | | | | | |
|---|---|---|---|---|---|---|---|
| | | Urban | | Rural | | Total | |
| | | No. | % | No. | % | No. | % |
| Male | ≤ 80 | 0 | 0.0 | 7 | 11.5 | 7 | 4.6 |
| | 80 – 100 | 24 | 26.7 | 19 | 31.1 | 43 | 28.5 |
| | > 100 | 66 | 73.3 | 35 | 57.4 | 101 | 66.9 |
| **Total** | | **90** | **100.0** | **61** | **100.0** | **151** | **100.0** |
| **$\chi^2$ = 11.97, df = 2, p <0.01** | | | | | | | |
| Female | ≤ 80 | 4 | 6.5 | 9 | 9.9 | 13 | 8.5 |
| | 80 – 100 | 13 | 21.0 | 34 | 37.4 | 47 | 30.7 |
| | > 100 | 45 | 72.6 | 48 | 52.7 | 93 | 60.8 |
| **Total** | | **62** | **100.0** | **91** | **100.0** | **153** | **100.0** |
| **$\chi^2$ = 6.13, df = 2, p <0.05** | | | | | | | |
| Total | ≤ 80 | 4 | 2.6 | 16 | 10.5 | 20 | 6.6 |
| | 80 – 100 | 37 | 24.3 | 53 | 34.9 | 90 | 29.6 |
| | > 100 | 111 | 73.0 | 83 | 54.6 | 194 | 63.8 |
| **Total** | | **152** | **100.0** | **152** | **100.0** | **304** | **100.0** |
| **$\chi^2$ = 14.09, df = 2, p <0.001** | | | | | | | |

It is found that in urban community there was no male who took less than 80% of phosphorus of RDA while in rural area it was 11.5%. About two third of urban males 73.3% and more than half 57.4% of rural males took phosphate more than RDA while in range of taking phosphorus (80-100%) of RDA was observed to be among 26.7% males in urban and among 31.1% of males in rural community and difference in proportion between urban and rural is found to be statistically highly significant. The female subjects of urban and rural community consumed phosphorus less than 80% of RDA in 6.5% and 9.9% whereas more than 100% of RDA in 72.6% and 52.7% respectively. Statistical test verifies the fact that there is significant difference in proportion of females belong to urban and rural community in relation to different level of phosphate intake of RDA (Table 9).

**Table No. 10 : Region wise Distribution of average phosphorus intake (in mg) between male and female respondents**

| Sex | Region | | | Statistics | | |
|---|---|---|---|---|---|---|
| | Urban | Rural | Total | t | df | p |
| | Mean ± SD | Mean ± SD | Mean ± SD | | | |
| Male | 723.70 ± 122.68 | 634.03 ± 113.05 | 687.48 ± 126.46 | 4.55 | 149 | <0.001 |
| Female | 679.81 ± 119.88 | 605.26 ± 77.88 | 635.47 ± 103.48 | 4.66 | 151 | <0.001 |
| **Total** | **705.80 ± 123.07** | **616.81 ± 94.31** | **661.30 ± 118.18** | **7.08** | **302** | **<0.001** |
| | **t = 2.19<br>F = 150<br>P<0.05** | **t =1.86<br>df = 150<br>p>0.05** | **t = 3.93<br>df = 302<br>p<0.001** | | | |

Table (10) elucidate the facts that the mean intake of phosphorus among male and female subject was higher (723.70 and 679.81) mg in urban community than rural areas as it was (634.03 and 605.26) mg respectively same trend is also observed by Harinarayan et al (2007) in his study. There is significant difference between male and female subjects in urban community and insignificant in rural as well as highly significant difference is observed between rural and urban areas of male, female as well as for both.

**Table No. 11: Region wise Distribution of the male respondents on the basis of phosphorus intake (in mg) in relation to different types of specified variables**

| Variability | Region | | | Statistics | | |
|---|---|---|---|---|---|---|
| | Urban | Rural | Total | t | df | p |
| | Mean ± SD | Mean ± SD | Mean ± SD | | | |
| **Age** | | | | | | |
| ≤ 30 | 728.29 ± 134.30 | 644.30 ± 104.28 | 697.19 ± 129.62 | 2.40 | 52 | <0.05 |
| 31 – 45 | 728.62 ± 115.96 | 641.23 ± 116.49 | 687.31 ± 123.26 | 2.78 | 53 | <0.01 |
| > 45 | 712.63 ± 118.19 | 607.87 ± 121.71 | 675.21 ± 128.44 | 2.72 | 40 | <0.01 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Total** | **723.70 ± 122.68** | **634.03 ± 113.05** | **687.48 ± 126.46** | | | |
| | **F = 0.15 p>0.05** | **F =0.53 p>0.05** | **F = 0.35 p>0.05** | | | |
| **Family Type** | | | | | | |
| Joint | 751.42 ± 116.45 | 617.08 ± 120.40 | 690.14 ± 135.25 | 4.27 | 55 | <0.001 |
| Nuclear | 709.14 ± 124.32 | 646.63 ± 107.29 | 685.86 ± 121.53 | 2.48 | 92 | <0.05 |
| | **t = 1.57 df = 88 p >0.05** | **t = 1.01 df = 59 p>0.05** | **t = 0.20 df = 149 p>0.05** | | | |
| **Type of work** | | | | | | |
| Sedentary | 714.83 ± 134.60 | 640.62 ± 154.47 | 692.40 ± 143.24 | 1.59 | 41 | >0.05 |
| Moderate | 726.98 ± 116.38 | 620.84 ± 100.97 | 685.56 ± 121.69 | 4.24 | 80 | <0.001 |
| Heavy | 733.90 ± 127.62 | 655.06 ± 100.41 | 685.38 ± 115.94 | 1.76 | 24 | >0.05 |
| | **F = 0.13 p>0.05** | **F = 0.51 p >0.05** | **F = 0.04 P >0.05** | | | |
| **SES** | | | | | | |
| Low | 720.64 ± 126.09 | 654.86 ± 109.48 | 683.80 ± 119.28 | 1.40 | 23 | >0.05 |
| Medium | 717.03 ± 131.76 | 636.58 ± 117.59 | 672.72 ± 129.64 | 2.68 | 67 | <0.01 |
| High | 728.71 ± 118.24 | 590.89 ± 97.65 | 706.95 ± 125.17 | 3.29 | 55 | <0.01 |
| | **F = 0.09 p >0.05** | **F = 0.90 p>0.05** | **F = 1.16 p>0.05** | | | |
| **Education** | | | | | | |
| Low | 712.88 ± 136.58 | 634.65 ± 111.98 | 659.68 ± 123.24 | 1.52 | 23 | >0.05 |
| Medium | 759.03 ± 118.81 | 615.75 ± 113.01 | 693.26 ± 135.86 | 4.80 | 59 | <0.001 |
| High | 701.67 ± 120.01 | 665.38 ± 114.37 | 692.74 ± 118.81 | 1.06 | 63 | >0.05 |
| | **F = 2.25 p >0.05** | **F = 0.98 p>0.05** | **F = 0.72 p>0.05** | | | |
| **Income** | | | | | | |
| ≤ 1000 | 726.86 ± 110.16 | 655.63 ± 110.22 | 691.11 ± 114.09 | 1.72 | 26 | >0.05 |
| 1000 – 2500 | 736.14 ± 133.23 | 618.44 ± 98.36 | 673.37 ± 129.28 | 0.93 | 58 | <0.001 |
| >2500 | 715.52 ± 121.59 | 647.40 ± 144.44 | 699.30 ± 129.51 | 1.81 | 61 | >0.05 |
| | **F = 0.25 p>0.05** | **F = 0.65 p>0.05** | **F = 0.66 p>0.05** | | | |

Although the urban male respondents were consuming on an average significantly more mean amount of phosphorus than rural males among various group of specified variables except sedentary and heavy type of worker, among low SES, among low and higher educational status as well as among low and high monthly per capita income group respectively.

**Table No.12: Region wise Distribution of the female respondents on the basis of phosphorus intake (in mg) in relation to different types of specified variables**

| **Variability** | **Region** | | | **Statistics** | | |
|---|---|---|---|---|---|---|
| | **Urban** | **Rural** | **Total** | **t** | **df** | **p** |
| | **Mean ± SD** | **Mean ± SD** | **Mean ± SD** | | | |
| **Age** | | | | | | |
| ≤ 30 | 671.47 ± 136.03 | 606.50 ± 88.95 | 638.98 ± 118.24 | 1.88 | 42 | >0.05 |
| 31 – 45 | 696.15 ± 107.13 | 616.87 ± 71.23 | 645.50 ± 93.42 | 3.77 | 70 | <0.00 |
| > 45 | 662.57 ± 120.43 | 580.87 ± 77.32 | 611.78 ± 102.49 | 2.52 | 35 | <0.05 |
| **Total** | **679.81 ± 119.88** | **605.26 ± 77.88** | **635.47 ± 103.48** | | | |
| | **F = 0.43 p>0.05** | **F =1.67 p>0.05** | **F = 1.34 p>0.05** | | | |
| **Family Type** | | | | | | |
| Joint | 701.51 ± 125.14 | 610.44 ± 73.18 | 641.26 ± 102.66 | 3.71 | 63 | <0.001 |
| Nuclear | 667.88 ± 116.77 | 600.63 ± 82.37 | 131.19 ± 104.45 | 3.16 | 86 | <0.01 |
| | **t = 1.06 df = 60 p >0.05** | **t = 0.60 df = 89 p>0.05** | **t = 0.60 df = 151 p>0.05** | | | |
| **Type of work** | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Sedentary | 652.52 ± 108.52 | 605.37 ± 78.27 | 624.23 ± 93.99 | 2.59 | 103 | <0.05 |
| Moderate | 748.18 ± 129.48 | 606.20 ± 83.70 | 672.03 ± 127.46 | 3.97 | 36 | <0.001 |
| Heavy | 664.50 ± 7.77 | 602.13 ± 68.50 | 614.60 ± 65.94 | 1.23 | 8 | >0.05 |
| | **F = 4.17 p<0.05** | **F = 0.01 p >0.05** | **F = 3.29 P <0.05** | | | |
| | **Sign. Pairs 1 vs 2** | | **Sign. Pairs 1 vs 2** | | | |
| **SES** | | | | | | |
| Low | 733.58 ± 169.23 | 597.25 ± 76.65 | 622.29 ± 111.34 | 3.74 | 47 | <0.001 |
| Medium | 653.24 ± 118.87 | 606.53 ± 84.67 | 626.75 ± 102.75 | 1.88 | 65 | >0.05 |
| High | 691.75 ± 93.66 | 626.23 ± 60.01 | 668.73 ± 88.38 | 2.27 | 35 | <0.05 |
| | **F = 1.78 p >0.05** | **F = 0.68 p>0.05** | **F = 2.60 p>0.05** | | | |
| **Education** | | | | | | |
| Low | 683.67 ± 134.98 | 597.09 ± 77.04 | 615.78 ± 98.25 | 3.19 | 67 | <0.01 |
| Medium | 678.78 ± 109.19 | 608.04 ± 85.78 | 635.72 ± 100.69 | 2.45 | 44 | <0.05 |
| High | 678.76 ± 122.29 | 645.67 ± 42.13 | 670.93 ± 109.10 | 0.80 | 36 | >0.05 |
| | **F = 0.01 p >0.05** | **F = 1.55 p>0.05** | **F = 3.60 P<0.05** | | | |
| | | | **Sign.pairs 1 vs 3** | | | |
| **Income** | | | | | | |
| ≤ 1000 | 663.45 ± 167.91 | 614.27 ± 73.21 | 625.94 ± 104.07 | 1.56 | 57 | >0.05 |
| 1000 – 2500 | 656.41 ± 109.91 | 593.74 ± 83.64 | 619.75 ± 99.43 | 2.36 | 51 | <0.05 |
| >2500 | 708.42 ± 93.68 | 602.07 ± 81.18 | 669.51 ± 102.38 | 3.67 | 39 | <0.01 |
| | **F = 1.30 p>0.05** | **F = 0.65 p>0.05** | **F = 3.17 P<0.05** | | | |
| | | | **Sign.pairs 1 vs 3** | | | |

The analysis clearly shows that average mean phosphorus intake was higher among urban females comparatively to rural females of various group of studied independent variables but significant difference between urban and rural area is found among (31-45) years and more than 45 years of age group, among nuclear as well as joint type of family, among sedentary and moderate type of work, among low and high SES, low and medium educational status as well as among medium and high monthly per capita income group of females respectively.

## CONCLUSION

It may be concluded that in both the studied community majority of the respondents belong to 31-45 years of age group while the percentage of male was higher than female in urban and it was just reverse in rural community. Rural subjects have significantly, and low socioeconomic status as compare to urban subjects. The mean calcium intake is found to be more among rural male and females than urban male and females respectively but difference is not significant. The mean oxalate intake is insignificantly higher among rural males than urban but among females it was significantly higher in urban community in comparison to rural. It is seen that the proportion of male and female subjects belong to rural area consuming less than RDA of phosphorus is more than the urban male and female subjects respectively & the differences is significant.

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