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Original Research Article

Cross-sectional study to know the prevalence of liver dysfunction, anemia and metabolic syndrome in the Koraga community in Udupi district of South Karnataka, India

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Abstract

Koraga community is considered to be one of primitive tribal groups (PTGs) deprived of social benefits. Most of the Koraga community in South India is spread around Western Ghats forest. Since they are deprived of social benefits, there are numerous government and non-government sponsored programme to uplift the community. The objective of this study was to identify the incidence of metabolic syndrome, anemia and altered liver function in the Koraga community residing in Udupi district, South Karnataka, India. Routine health check-up camp was conducted exclusively for Koraga community residing in Udupi district. Both males and females irrespective of age group were checked for height, weight, waist circumference, blood pressure. Random blood samples were collected for assessing haemoglobin, blood sugar, lipid profile and liver function parameters. Body mass index (BMI) and waist to hip ratio (WHR) were calculated using anthropometric measurements.Haemoglobin levels are found to be decreased in Koraga community people ($p<0.0001$). There was a significant liver dysfunction in them ($p<0.0001$). Interestingly, BMI and waist circumference of Koraga people were significantly lower than that of control population ($p<0.0001$), but their WHR was found to be significantly higher ($p<0.0001$). Among lipid profile parameters, there was significant increase total cholesterol and triacylglycerol ($p<0.0001$), but it may be because of random blood sample. Our study indicates, definite presence of anaemia in the female population of the Koraga community, and liver dysfunction in the Koraga community as a whole, mostly alcohol induced. Our study gives a clue towards presence of obesity in Koraga females, but to prove or disprove the presence of metabolic syndrome in the Koraga community, further studies are needed.

Keywords: Anthropometric measurements; BMI; Haemoglobin; Koraga community; Liver function; Lipid profile; Metabolic syndrome; Waist to hip ratio

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1. Introduction

Primitive Tribal Groups (PTGs) are classified based on the criteria of pre-agricultural level of technology, less than five per cent literacy, marginal or stagnant rate of growth etc. The PTGs in India are seen distributed in 15 States/Union Territories.[1] There are 50 major tribes with 109 sub-tribes in the State (as of March 2005), according to the notified Schedule under Article 342 of the Constitution of India. From these, the Government of Karnataka has identified (i) Jenu Kuruba; and (ii) Koraga tribes as primitive groups (PTGs).[2] Apart from Koraga tribes the undivided Dakshina Kannada district also has Marathi and Malekudiya. The Marati, Malekudiya, and Koraga tribes are three different endogamous tribal populations living in similar ecological conditions.[3] Koraga's are still at the most primitive stage, and majority of them inhabit the western slope of the Western Ghats.[1] They continue to live in isolated areas and practice either primitive agriculture or no agricultural practice and most of them are still in food gathering stage with almost stagnating population. According to the surveys conducted by the department of Tribal Welfare, these tribes predominantly stay in districts where they originally belong to, however the possibility of tribal migration to neighbouring districts for better employment opportunities cannot be denied. Whether the migrated tribes have been mainstreamed into the society or still continue to live as primitive groups, statistics are unavailable.[2] The Koraga community suffered from extreme untouchability in the past. They were treated as 'untouchables" than tribals even by Scheduled Castes. In earlier days they used to remove carcasses and ate carrion. The economy of the Koraga community is based on basketry, agriculture labour, laterate stone cutting, beedi rolling and wage labour. The major share of the money earned is spent for alcohol consumption. Both males and females are addicted to liquor, minor vices like betel chewing, smoking etc.[1] The land which has been allotted to Koraga's during rehabilitation programme by governmental organization is either barren or uncultivable, and they have poor housing and living conditions.

There are numerous government programmes for the welfare of tribal communities, one such programme is Sector Development Project (SDP) which constitutes Indigenous People's Development Framework (IPDF). The IPDF is a policy and procedural framework for Indigenous People Development Plans (IPDPs) which provides resource for development programme for tribal communities. The Ministry of Tribal Affairs, Government of India (GoI) and the National Commission on Schedule Castes and Schedule Tribes has established Schedule Caste/Tribe Commission for indigenous people's affairs and development needs. Indigenous Peoples Policy ensures equality of opportunity for such people. It aims to ensure that any bank-assisted development interventions which will have any impact on such people will be consistent with the needs and aspirations of affected indigenous people and compatible in substance and structure with affected indigenous people culture and social and economic institutions.[2] There is lack of effective implementation of programmes by government and non-government organizations. Along with their financial difficulties, Koraga people also suffer from health related issues because of lack of facilities, ignorance, and illiteracy and because of their unhealthy habits. The disease detection camp could identify many cases like tuberculosis, leprosy, cataract, jaundies, scabies, malnutrition, viral fever, typhoid, skin diseases, low birth weight of new born etc., among this community.[1] To improve the health condition of the Koraga people, many government and non-government organizations are organizing many programmes. They have conducted health improvement classes followed by health training classes, monthly routine immunization programmes, disease detection camps, nutritional supplementary programme etc.[1] In-spite of such efforts, these people are still not getting good medical care and

access to modern medicine for them is difficult. We have conducted health camp for Koraga people in Udupi district and undertaken this study to know the prevalence of liver dysfunction, anaemia and metabolic syndrome.

2. Materials and methods

The study was carried out on 76 people belonging to the Koraga community spread over Udupi district, more from Kundapur Taluk who attended the health camp conducted by Dr A.V. Baliga Hospital, Udupi, South Karnataka, India, and 52 non-alcoholic healthy volunteers. Anthropometric measurements were taken using standard protocol and values are expressed as mean±SD in Table 1. Medical and personal history was obtained from both Koraga people and healthy volunteers using standardized medical history questionnaire, responses are presented in tabular form (Table 2). Random blood samples from both Koraga people and healthy volunteers were obtained into vacutainers. The plain blood was allowed to clot for 30 minutes and then centrifuged at 2000×g for 15 min for separation of serum. The serum is then assayed for liver function markers such as ALT, AST, total bilirubin (TB), direct bilirubin (DB), lipid profile and antioxidant markers total thiol and oxidants like malondialdehyde (MDA). All assays were performed immediately after the separation of serum. Random blood glucose (RBS) was determined using anti-coagulated blood sample. Healthy volunteers were non-alcoholics, non-smokers and free from any chronic inflammatory diseases and were not on any kind of medications. Informed consent was taken from all the subjects involved in the study. This study was approved by the institutional ethical review board of Manipal University for human research. Special chemicals such as 5 5'-dithio-bis (2-nitrobenzoic acid) (DTNB), MDA and reduced glutathione (GSH) were obtained from Sigma Chemicals Co. (St Louis, MO). All other reagents used were of analytical grade.

Table 1: Demographic and anthropometric parameters in the Koraga population and healthy controls (expressed in mean±SD)

	Healthy controls (n = 52)	**Koraga people (n = 76)**
Age (years)	30.51±5.74	38.36±13.41*
Sex (M/F)	22/30	31/45
Body mass index (BMI)	21.26±1.31	19.16±3.36*
Waist to hip ratio (WHR)	0.82±0.02	0.92±0.05*
Abdominal circumference (AC)	81.01±2.10	69.97±8.52*
Height (meters)	1.53±0.06	1.54±0.07
Weight (kg)	43.92±6.81	45.07±8.39
Blood pressure (mm Hg) (Systolic/Diastolic)	121.84±11.68/82.30±10.95	30.51±5.74/38.36±13.41

*p<0.0001 compared to healthy controls

Table 2: Response of Koraga people to the medical history questionnaire obtained during health camp

Personal history	Males (Total No. 31) (%)*	Females (Total No. 45) (%)*
Do you live with people who smoke?	29/31=93.54	35/45=77.77
Did your parents smoke when you were young?	28/31=90.32	21/45=46.46
Have you ever used tobacco? (beedi in males)	26/31=83.87	30/45=66.7
Have you ever used alcohol beverages? (kallu, liquor)	31/31=100	34/45=75.5
Family history		
Did parents die of tuberculosis?	11/31=35.48	11/45=24.4
Did parents die of cancer?	2//31=6.45	4/45=8.9
Did parents die of liver failure/	3/31=9.67	4/45=8.9

*Postive responses

All the biochemical parameters were determined using kit methods in automated analyzer, Hitachi model 912 (Hitachi 912, Roche Diagnostics, Germany). Serum aspartate transaminase (AST) and alanine transaminase (ALT), alkaline phosphatase (ALP), serum total protein levels were determined using Biuret method, albumin level was measured by the bromocresol purple dye-binding method, urea by the urease-glutamate dehydrogenase method, and creatinine by Jaffe's method, whole blood haemoglobin by modified benzidine method, total and direct bilirubin by Jendrassick and Groof method.[4-12] Fasting lipid profile, total cholesterol estimation was done by cholesterol oxidase method; HDL-cholesterol was estimated by same method after precipitating the LDL, VLDL, and chylomicrons.[13] Triglycerides were estimated by enzymatic mixture containing lipoprotein lipase, glycerol kinase and glycerol-3-phosphate oxidase and peroxidase.[14] Low density lipoprotein levels were calculated by using Fridewald's formula.[15] TC/HDL-C ratio was calculated.

Statistical analysis was performed using Statistical Package for Social Sciences, version 16.0 (SPSS Inc. Chicago, USA). Independent sample t test was used to compare the mean values between the groups. Mean values with larger standard deviation were analyzed using non-parametric t test (Mann-Whitney U and Wilkoxon W tests). Pearson's correlation was applied to correlate between the parameters. The results were expressed as mean±SD in a tabular form. A p-value <0.05 was considered statistically significant.

3. Results

On independent sample t test, as depicted in Table 3, serum AST ($p<0.0001$), ALT ($p<0.0001$) and ALP ($p<0.0001$) levels were significantly higher in Koraga people. Serum total protein ($p<0.0001$), albumin ($p<0.05$) and globulin ($p<0.0001$) levels were decreased in Koraga people. Among the lipid profile parameters, total cholesterol ($p<0.0001$) and triacylglycerol ($p<0.0001$) levels were at significantly higher levels in Koraga people compared to the control group. Interestingly, body mass index (BMI) ($p<0.0001$) and abdominal circumference ($p<0.0001$) measurements were significantly below that was found in the control population,

Table 3: Haemoglobin, liver function parameters and lipid profile in the Koraga population compared to healthy controls (expressed in mean±SD)

	Healthy controls (n = 52)	Koraga people(n = 76)
Haemoglobin (g/dl)	13.98±1.36	12.10±7.12
Total bilirubin (mg/dl)	085±0.28	0.85±0.32
Direct bilirubin (mg/dl)	0.13±0.17	0.12±0.16
AST (IU)	18.15±3.80	42.88±22.57*
ALT (IU)	14.45±3.97	36.56±19.12*
RBS (mg/dl)	105.73±10.20	106.28±23.71
Serum urea (mg/dl)	28.76±5.10	23.28±7.50*
Serum creatinine (mg/dl)	0.87± 0.21	0.88±0.13
ALP (IU)	69.03±11.75	151.77±34.49*
Total protein (g/dl)	7.30±0.49	6.88±0.56*
Albumin (g/dl)	4.15±0.66	3.89±0.64**
Globulin (g/dl)	3.49±0.17	3.00±0.53*
Total cholesterol (mg/dl)	156.26±26.60	177.50±28.75*
Triacylglycerol (mg/dl)	145.76±17.65	132.27±33.90
HDL-cholesterol (mg/dl)	47.53±7.40	46.86±5.46
LDL-cholesterol (mg/dl)	104.98±5.83	101.65±26.27
VLDL (mg/dl)	27.94±5.56	26.59±6.78

*p<0.0001 compared to healthy controls, **p<0.05 compared to healthy controls

Table 4: Selected parameters having large SD were analyzed by non-parametric t test using Mann-Whitney U, and Wilcoxon W test showing Z values and the significance level

	Mann-Whitney U	Wilcoxon W	Z	P value
Haemoglobin (g/dl)	719.50	3645.50	-6.113	0.0001
AST (IU)	174.00	1552.00	-8.745	0.0001
ALT (IU)	229.00	1607.00	-8.481	0.0001
Albumin (g/dl)	1621.00	4597.00	-1.727	0.084
Total cholesterol (mg/dl)	1267.50	2645.50	-3.440	0.001
LDL-cholesterol (mg/dl)	1669.50	4595.50	-1.489	0.136
Abdominal circumference (Centimeters)	431.00	3557.00	-7.505	0.0001
Body mass index	869.00	3795.00	-5.382	0.0001
Waist to hip ratio	180.00	1558.00	-8.732	0.0001
Age (years)	1217.50	2595.50	-3.684	0.0001

however, the waist to hip ratio (WHR) was found to be higher in Koraga people ($p<0.0001$). Both the systolic and diastolic blood pressure in Koraga people was comparable to that of the control group.

Since some of the measured parameters have shown huge deviation (SD) from mean, we have applied non-parametric t test using Mann-Whitney U and Wilcoxon W tests, on applying non-parametric t test, as depicted in Table 4, there was a significant decrease in hemoglobin levels in Koraga people ($p<0.0001$). Other parameters like AST ($p<0.0001$), ALT ($p<0.0001$), total cholesterol ($p<0.0001$) and WHR ($p<0.0001$) were significantly higher in Koraga people, where as abdominal circumference ($p<0.0001$) and WHR ($p<0.0001$) were found to be significantly lower in Koraga people compared to control group.

On applying Pearson's correlation, we have found significant positive correlation between total cholesterol and WHR ($r = 0.380$, $p<0.0001$) (Fig. 1), triacylglycerols correlated positively with both BMI ($r = 0.272$, $p<0.002$) and abdominal circumference ($r = 0.391$, $p<0.0001$) (Fig. 2). BMI correlated positively with abdominal circumference ($r = 0.709$, $p<0.0001$). WHR correlated negatively with abdominal circumference ($r = -0.264$, $p<0.003$) (Fig. 3) and positively with body weight ($r = 0.179$, $p<0.05$) (Fig. 4). Abdominal circumference correlated positively with body weight ($r = 0.414$, $p<0.0001$) (Fig. 5), as expected height correlated positively with weight ($r = 0.505$, $p<0.0001$) and BMI correlated positively with body weight ($r = 0.433$, $p<0.0001$), and systolic blood pressure correlated positively with diastolic blood pressure ($r = 408$, $p<0.0001$).

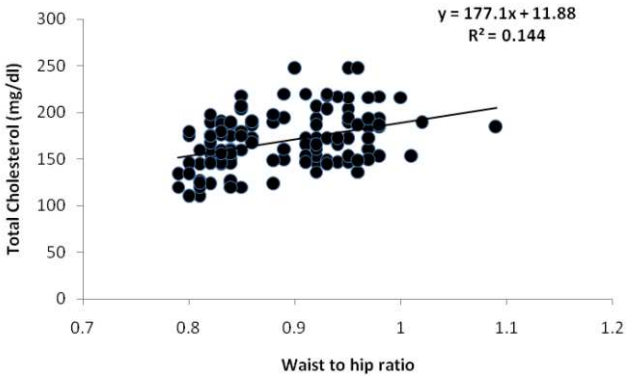

Fig. 1: Correlation between total cholesterol and waist to hip ratio

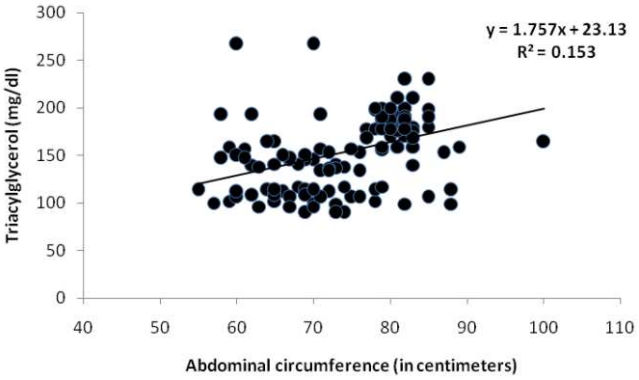

Fig. 2: Correlation between abdominal circumference and triacylglycerol

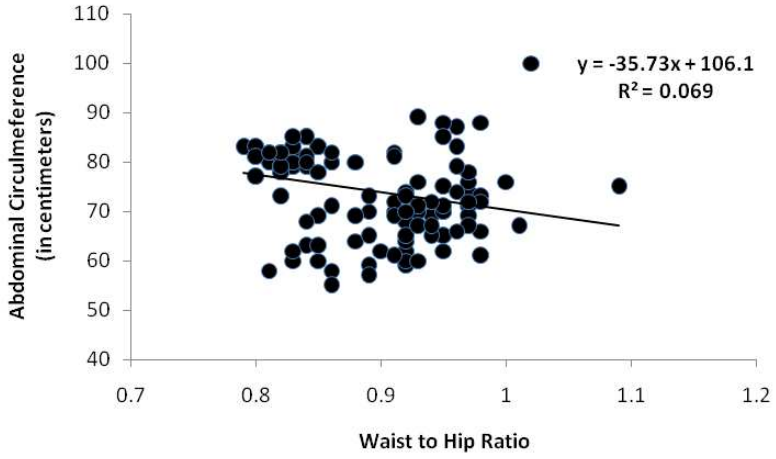

Fig. 3: Correlation between waist to hip ratio (WHR) with the abdominal circumference

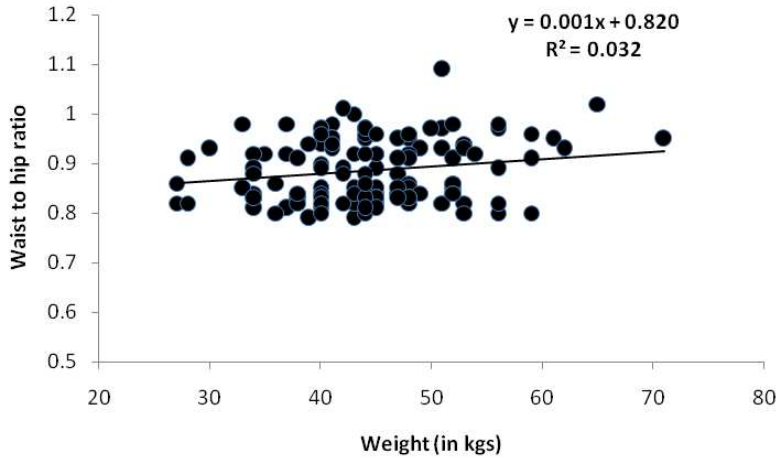

Fig. 4: Correlation between waist to hip ratio and body weight

4. Discussion

As depicted in Table 1, majority of Koraga people who attended the health camp were females, 45 out of total 76. On anthropometric measurements, there was no significant difference in height and weight in terms of mean and SD between the control group and Koraga people, but interestingly, on calculating BMI (height in meter square divided by weight in kilograms) we have noticed BMI values being lower than that observed in the control group (19.16±3.36 vs 21.26±1.31), we have seen similar observation in abdominal circumference (69.97±8.52 vs 81.01±2.10) indicating the anthropometric indices for obesity measurement are at lower levels in Koraga people compared to the control group, this may be due to their overall malnutrition and health related issues, and also in-part due to their hardship in earning daily bread.

However, the other interesting finding that we have noticed is the WHR in Koraga people was at

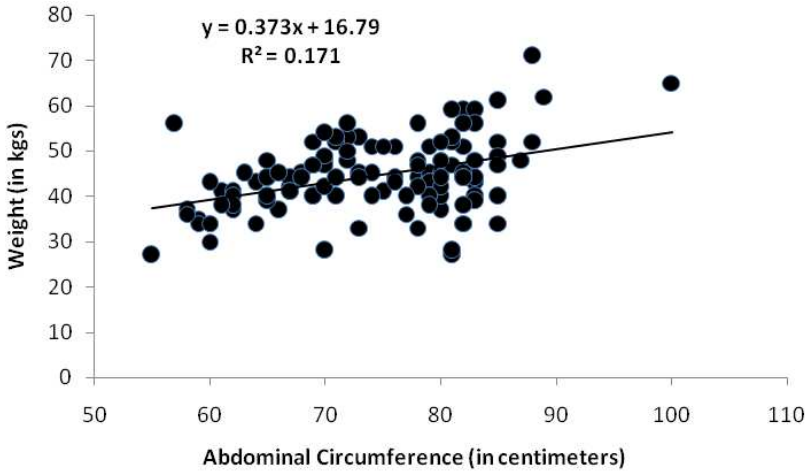

Fig. 5: Correlation between abdominal circumference and body weight

higher level compared to the control group (0.92±0.05 vs 0.82±0.02), this indicates presence of feminine type of obesity. This may be explained by the fact that the majority of Koraga people who attended the camp were females and the significantly higher values of WHR in this group compared to control may indicate towards the presence of obesity in female population of Koraga community. However, there are few biases in this study like bias related to age and number of females in control group compared to Koraga population. Moreover, just by noting increase in WHR in Koraga females, it is difficult to conclude that there is female obesity in the Koraga community. However, it is a subtle indication or possible suspicion towards presence of female obesity in the Koraga community.

Many government and non-government organizations work for the improvement of lifestyle in Koraga people. Many health camps and nutrition supplementation programmes are conducted to better the life of Koraga people. But such efforts are not fruitful till now, it may be because of lack of basic living conditions and out of reach of health facilities because of their remote domicile or lack of awareness, and ignorance towards health and social well-being among them. Surprisingly, we have found prevalence of anaemia in the Koraga community, since most of the people who attended the camp were females, so this finding is most sensitive in knowing the prevalence of anaemia in the Koraga females, which possibly indicates the presence of higher neonatal mortality rate in the Koraga community. Although, the state government has made mandatory distribution of iron and folic acid to all pregnant women but our finding of lower haemoglobin level in them indicates that either such facilities are out of reach to Koraga people or Koraga people are ignorant about such supplementation. However, all efforts must be made to supplement iron and folic acid to all Koraga pregnant women to safe guard the health of newborn and unborn.

In consistent with our previous study, we have noticed similar findings in this study that there is significant liver dysfunction in Koraga people.[17] Increased presence of serum liver enzymes like AST, ALT and ALP, and decreased synthesis of total protein and albumin in this community indicates that there is significant alteration in liver function. This is due to, as discussed in our previous manuscript, the fact that most of the Koraga people irrespective of the gender consume alcohol almost daily, majority of their daily wages will be spent towards alcohol consumption and smoking habits, as is evident

from the medical history questionnaire, around 75% of them were alcoholics and 66% of them were smokers.

Koraga people are exposed to the most type of crude or unrefined alcohol, because of the cost factor, and such alcohol is more dangerous as it induces inflammation of hepatocytes leading to alcoholic hepatitis and cirrhosis. Koraga people are also active and passive smokers, as they live in ill-ventilated houses and most of the adult family members, especially males, are smokers and the children will be passive smokers. Passive smoking was around 77% in our study. Most common cause of death in Koraga people is found to be tuberculosis, according to our medical questionnaire (around 25% of them died due to tuberculosis alone), and other reports also suggest the same.[1]

On analyzing for lipid profile parameters, we have found significantly elevated levels of total cholesterol and triacylglycerol levels in Koraga people but this may be a bias because the sample we have used to analyze lipid profile was random sample and the consumption of breakfast before the camp might have had influence on these parameters. Nevertheless, this can be taken as just a possible indicator towards lipid level alteration and further studies can be taken up in this aspect to know the details. Classic correlation patterns of different anthropometric measurements and lipid profile parameters (Fig. 1-5) may possibly indicate there may be existence of obesity or lipid abnormalities leading towards metabolic syndrome in Koraga people, but at present it is difficult to comment on this with the limited and biased data.

In conclusion, our study indicates, definite presence of anaemia in the female population of the Koraga community, and liver dysfunction in the Koraga community as a whole, mostly alcohol induced. Our study gives a clue towards presence of obesity in Koraga females, but to prove or disprove the presence of metabolic syndrome in the Koraga community, further studies are needed.

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