

## **Academic Performance and Nutritional Status – A Case Study on College Students in North Tripura.**

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**Abstract:** *The development of any nation or community depends largely on the quality of education of such a nation. Understanding the nature of the causal relationship between health and education is important to determine the exact relation between them. The mechanism by which health and nutrition influence educational achievement is not well established, but poor health and malnutrition in early childhood may affect cognitive abilities, necessary for learning process and consequently educational achievement. This study shows that that, firstly, the tribal students have lower BMI values than their nontribal counterparts which may be due to dietary differences – tribal students have less access to convenience foods and as such may have less consumption of these type of empty calorie containing foods. Also the academic achievements of tribal students are a little lower than their nontribal counterparts which again comes out in the regression and negative correlation of BMI with academic achievement.*

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### **I. Introduction**

The development of any nation or community depends largely on the quality of education of such a nation. It is generally believed that the basis for any true development must commence with the development of human resources [1] It has been argued that health is an important factor for academic achievement at school [2,3] and in higher education [4]. Consequently, in the context of universities or colleges, promoting the health and well-being of all members means promoting effective learning [5]. A systematic literature review to examine whether school health programmes improved academic success provided positive evidence for at least some programmes [6]. Similarly, another review showed positive associations between parameters of health (e.g., school-based physical activities) and academic outcomes/performance [6]. Chronic malnutrition experienced during early life inhibits growth, retards mental development, and reduces motivation and energy level, causing a reduction of educational attainments and delay in school entry [2]. Understanding the nature of the causal relationship between health and education is important to determine the exact relation between them. From a policy point of view, understanding the relationship between health and education is essential to formulate new possible policy interventions targeted to the improvement of children's status in developing countries. Given the growing importance of the potential strong connection between nutrition and schooling in developing countries the analysis presented in this work makes progress in sorting out such a casual relationship. Furthermore, investments in health is expected to have positive effects on education since the returns from investment in education last for many periods and health status is positively correlated with life expectancy. The mechanism by which health and nutrition influence educational achievement is not well established, but poor health and malnutrition in early childhood may affect cognitive abilities, necessary for learning process and consequently educational achievement. This study hopes to find out the answer to the relationship between the nutritional status of the students and its effect on their academic status and also suggest modalities of overcoming those problems performance in a sample of college students in Dharmanagar district in North Tripura which has hitherto not been documented by any worker. The study has its own set of limitations. Firstly, considering the epidemiological nature of the study, the sample size is small. Secondly, it represents only a fraction of the students of a particular college in North Tripura and thus is not suited to be extrapolated to the whole student population without undertaking a comprehensive large scale survey. Thirdly, due to paucity of funds and manpower, the researcher had to depend upon the students self provided information to the questionnaire.

### **II. Literature Review**

Malnutrition is a major problem in both developed and developing countries and deficiencies in some nutrients have been reported to cause diseases which could lead to impaired cognitive development [5]. Other studies have related lifestyle of students, particularly breakfast consumption, to their cognitive abilities as reflected in their academic performance [6-8]. However, most of these studies have excluded young adults in the tertiary institution. Undernourished children have been shown to have decreased attendance, attention, and

academic performance as well as experience more health problems compared to well-nourished children [15,18]. More recently, studies have examined the impact of breakfast on cognition, behavior, and academic performance of school-age children [15,19-21]. This research suggests some positive effect of breakfast on performance of specific cognitive tasks [15,20,21]. However, gaps exist in the literature examining the long-term effects of breakfast on academic performance and how the observed effects of breakfast on cognition are modified by age, sex, and nutritional status [15,21]. The single study not restricted to breakfast demonstrated a positive association between the consumption of regular meals and academic performance [22].

Most studies of health-promoting profiles of students, such as the European Health and Behavior Survey conducted in 20 countries, did not explore the associations between health and academic achievement [23]. Indeed Al-Kandari and Vidal [24] noted that no study has yet been published on e.g., nursing students' health promoting lifestyle profiles, particularly examining their relationship with academic performance and nursing courses. Conversely, most studies of the factors associated with students' educational attainment were mainly concerned with educational and/or demographic variables and did not concurrently explore the students' health-related parameters [25]. Geographically, the majority of research conducted assessed the associations between health/health programmes and academic achievement and were undertaken in the USA [26-28], with fewer studies from the UK or elsewhere [25]. Also the associations between health/health programmes and academic attainment were mostly examined in elementary, middle or high school children [29-33], rather than university/college students [25].

The potential for health to improve cognitive function, learning and academic achievement in children has received attention by researchers and policy makers [34]. It is widely accepted that health and well-being are essential elements for effective learning [2]. Vice versa, education is a strong predictor of lifelong health and quality of life in different populations, settings, and time [35]. However, the pathways through which education leads to better health and longer life expectancy are still not clearly understood. It is widely held, however, that education, health, and social outcomes are very closely interdependent [36].

Several studies have documented the relationship between poor health, nutrition and school achievement. Low anthropometric measurements (height-for-age, weight-for height and head circumference) have been frequently associated with poor school outcomes.[2,3-6,34-36]. In fact, in several of the studies, the relationship remained significant, even after controlling for socioeconomic variables.[3-5,9]. Iron-deficiency anemia, missing breakfast and helminthic infections have also been reported to affect school performance [3-6,34-36]. Eating disorders create a variety of medical conditions that occur more frequently in the college-age population. [50]. For college students these conditions are key factors that may have a lasting impact not only on their academic achievements while in school, but also on their professional performances before and after graduation.

Gardner and Grantham-McGregor stated that the mechanisms which link under nutrition and poor development in children are not well understood, although children who were moderately to severely malnourished during their early childhood show delayed development [37].

Studies of nutrition and academic performance have typically focused on hunger, malnutrition, and micronutrient deficiency [38-40]. The predominant approach to studying diet has focused on the role of individual nutrients or foods [41]. However; individuals do not consume single nutrients but combinations of foods [42]. In recognition of the multidimensional nature of diet, studies of the interrelations of nutrition and health have examined the effects of overall diet quality using summary measures of food and nutrient intake [42,43].

Academic performance influences future educational attainment and income, which, in turn, affect health and quality of life [44]. Moreover, as increased levels of educational attainment and income facilitate increased understanding of nutrition messages and access to healthy food, [45,47] This relationship has been observed as steady across different levels of socioeconomic status [49].

College students reported 52% of the time using exercising to lose weight and 62% eating 1-2 servings of fruit/vegetable per day [3]. Some 46% of college students reported getting enough sleep to feel rested in the morning across 3 to 5 days (Executive Summary, American College Health Association, 2011). Some 55%, on average, of all college students report 4 or more symptoms of clinical depression (i.e. overwhelmed, sadness, hopeless, difficulty functioning) [49].

### **III. Methodology**

#### **3.1 Identification and Selection of Subjects.**

The study was conducted on undergraduate students of Government Degree College, Dharmanagar, North Tripura. Subjects were randomly selected from across the all faculties in the campus. Subjects who had taken ill in the last 4 weeks and those currently on medication will be exempted from the study. The age group of the subjects was 19-22 years and the same was verified from their date of birth as recorded in their Madhyamik examination admit card. A total of one hundred students (58 girls and 42 boys) completed the survey from one

hundred fifteen students selected for the survey. The subjects were explained the modalities and objectives of the study and informed oral consent were taken from the subjects as well as the principal of the college for undertaking the study.

**3.2 Anthropometric Measurements**

Recent studies [51,52] have demonstrated the applications of anthropometry to include the prediction of who will benefit from interventions, identifying social and economic inequity and evaluating responses to interventions. Height and weight of the subjects were recorded with the help of an anthrop meter and a weighing machine respectively which was calibrated every day before the start of work. All the anthropometric measurements were taken following the standard techniques recommended by Lohman *et al.* [53].

BMI was calculated as per WHO norms. It is calculated as the weight in kilograms divided by the square of the height in meters (kg/m<sup>2</sup>). BMI is age-independent and the same for both sexes [54]:

$$\text{Body Mass Index} : = \frac{\text{Body weight in kg}}{\text{Body height in m}^2}$$

For conducting diet survey, a minimum of three to four days of intake is generally required for characterizing usual individual intake of energy and the macronutrients [55]. If enough days are collected on each individual, this could be an appropriate measure to use for research in which the individual's usual intake is the unit of interest [55]. As to how many days are needed, there has been extensive research on this topic.[55,56]. Multiple days of diet records are considered by some to be a gold standard for collection of individual dietary data. For this study and dietary survey was conducted on each individual for a period of seven days. From this data, the nutritional status of each individual was calculated with the help of food composition table [57]. Standard Diet survey questionnaire as used by National Institute of Nutrition and ICMR modified as per requirement was used in collection of data.

**3.4: Assessment of Academic Performance**

Academic performance of the students were assessed by the marks scored by the students in the test exam conducted by the college prior to them being sent up for their university final exam. Since the students had a combination of subjects, so to bring in parity in assessment, the percentage of the total marks scored by the students were taken into consideration to rule out bias.

**IV. Results**

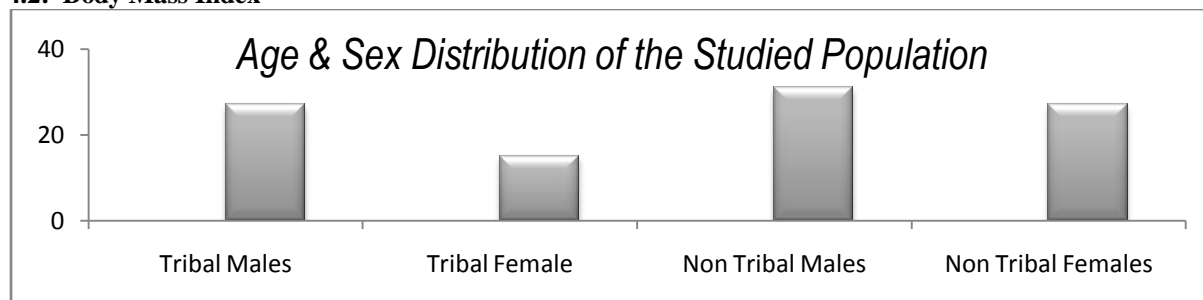
**4.1: Age and Sex Distribution of the Studied Population**

Table:1- Age and Sex Distribution of the Studied Population:

Age Range	Tribal Males	Tribal Female	Total Tribal Subjects	Non Tribal Males	Non Tribal Females	Total Non Tribal Subjects	Grand Total
Adolescent	27	15	42	31	27	58	100

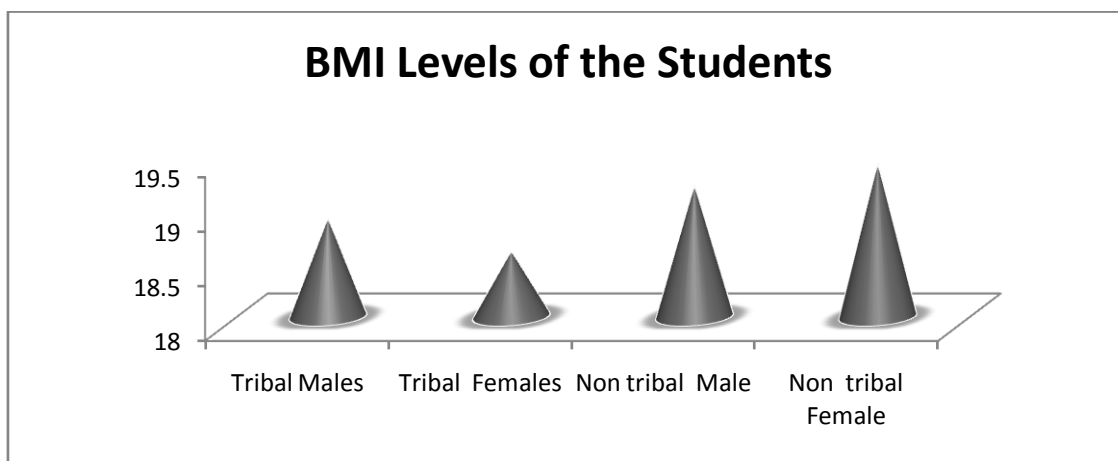
Fig 1 - Age and Sex Distribution of the Studied Population:

**4.2: Body Mass Index**



**TABLE: 2 BMI OF THE SURVEYED POPULATION (MEAN VALUE)**

CATEGORY	BMI VALUES
Tribal Males	18.9
Tribal Females	18.6
Non tribal Male	19.2
Non tribal Female	19.4



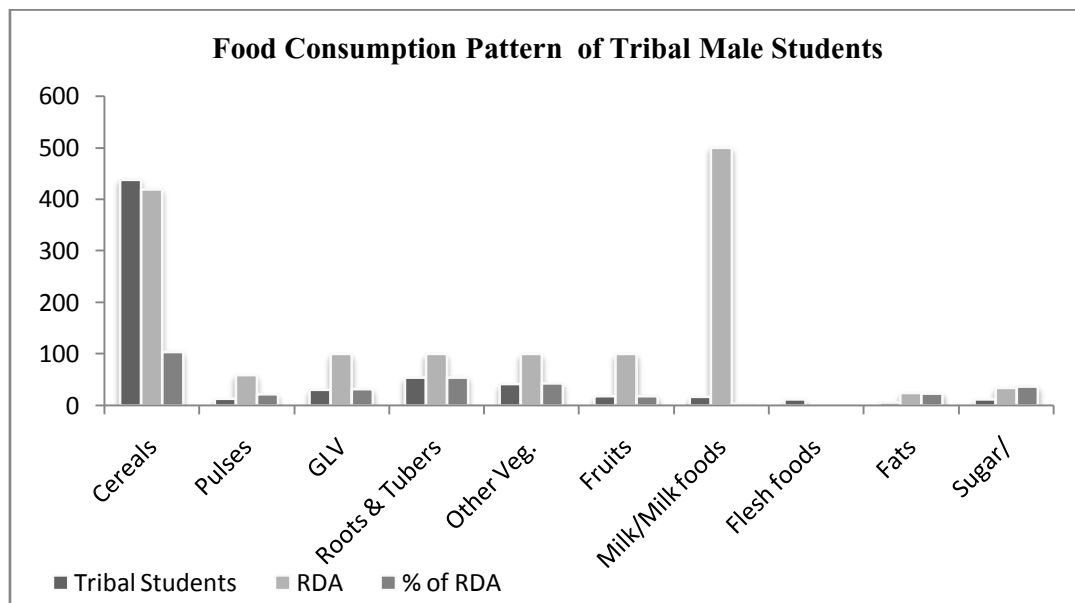
**Fig 2 – BMI Levels of the Students**

A study of the BMI values shows that nontribal students have a higher BMI value than their tribal counterparts, but then the BMI values shows that chronic under nutrition is not present in any of the study groups. The higher BMI levels in the nontribal students may be due to their food habit which is completely different from their tribal counterparts. While the tribal students partake of home cooked meals where they use very little of spices and mostly use boiled foods, the nontribal students seem to have an affinity for fast foods available in outlets across the town.

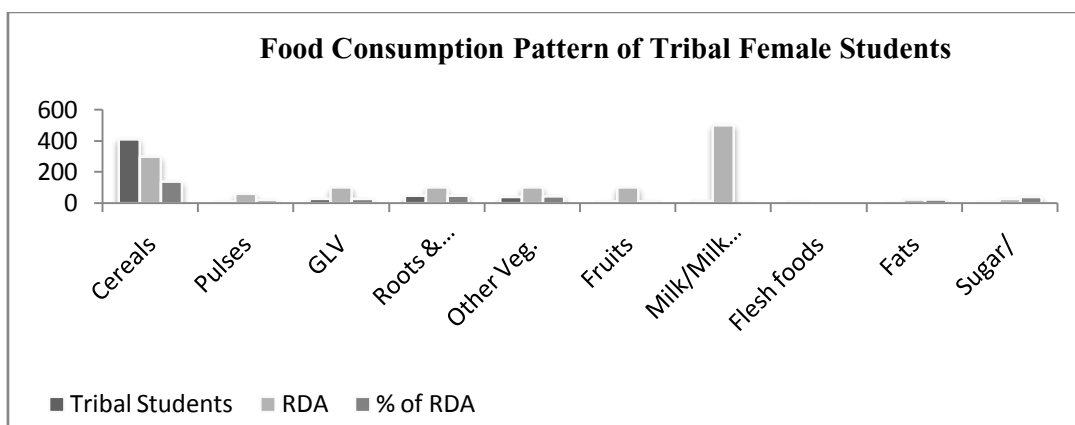
**4.3 Diet Survey**

**Table : 3 - Food Intake of Tribal & Non Tribal Students (Mean±SD)**

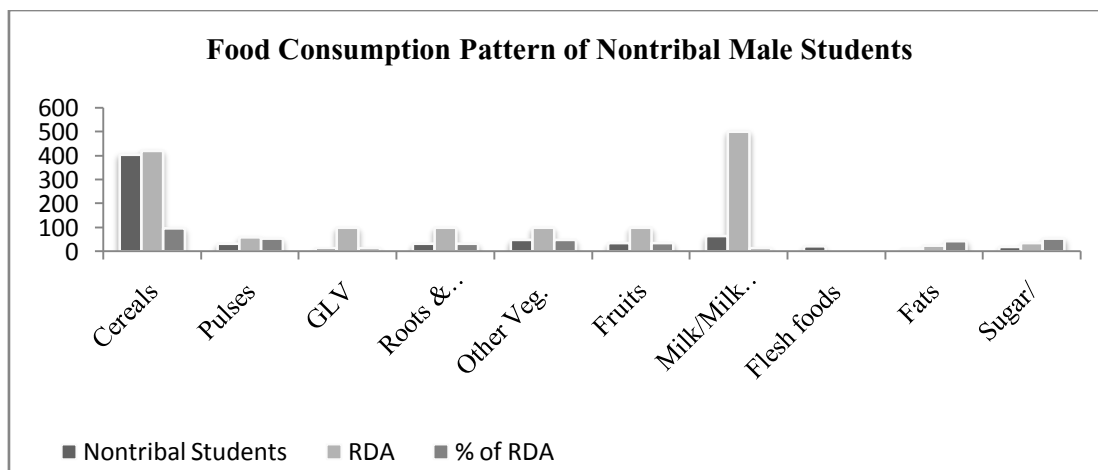
Population Type	Sex	Cereals	Pulses	GLV	Roots & Tubers	Other Veg.	Fruits	Milk/ Milk foods	Flesh foods	Fats	Sugar/ Jaggery
Tribal Students	M	438±36 .6	13±12 .8	31±8 .8	54±9. 7	42±6 .1	18±8 .3	17±5. 8	12±6 .7	6±4.4	12±5.2
	F	411±49 .9	12±11 .1	27±9 .5	49±12 .3	42±7 .9	12±9 .9	15±7. 5	11±5 .9	6±3.6	12±4.7
RDA	M	420	60	100	100	100	100	500	-----	25	35
	F	300	60	100	100	100	100	500	-----	25	30
% of RDA	M	104	22	32	55	43	19	4	-----	24	37
	F	137	20	28	49	43	13	3	-----	24	40
Nontribal Students	M	405±51 .2	32±15 .4	12±7 .7	31±9. 9	44±7 .4	35±4 .5	65±9. 1	22±3 .3	11±2. 2	19±3.8
	F	399±47 .1	26±10 .9	16±9 .2	35±10 .2	44±6 .4	16±2 .8	56±8. 6	18±4 .5	9±5.1	18±4.3
RDA	M	420	60	100	100	100	100	500	-----	25	35
	F	300	60	100	100	100	100	500	-----	25	30
% of RDA	M	97	53	13	32	47	35	13	-----	44	54
	F	133	43	17	35	44	16	11	-----	36	60



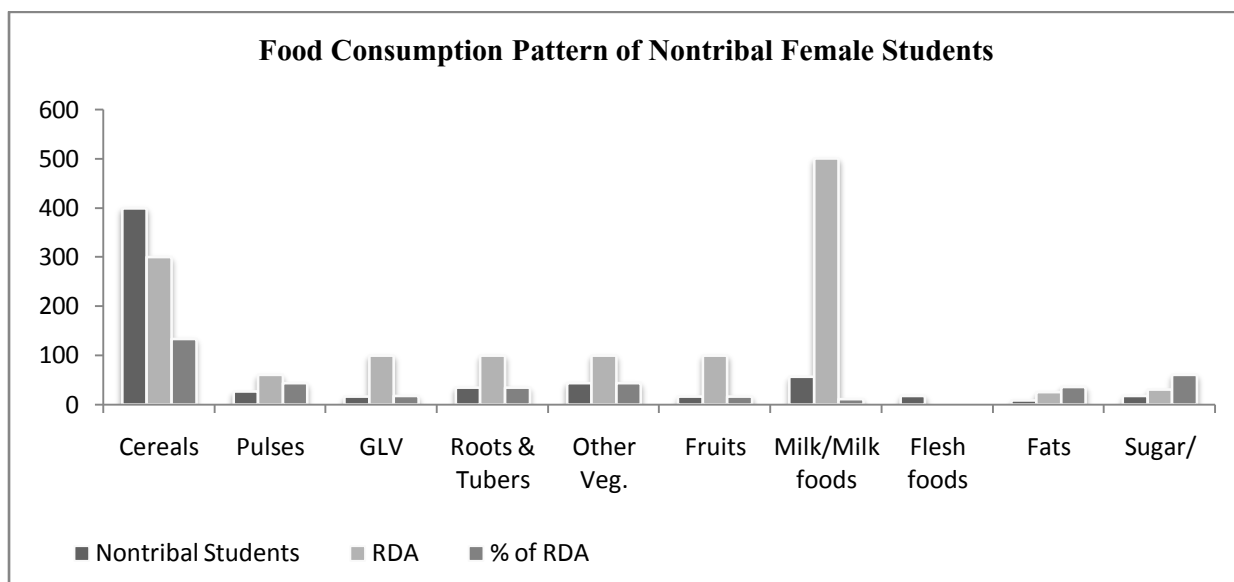
**Fig 3 – Food Consumption Pattern of Tribal Male Students**



**Fig 4 – Food Consumption Pattern of Tribal Female Students**



**Fig 5 – Food Consumption Pattern of Nontribal Male Students**

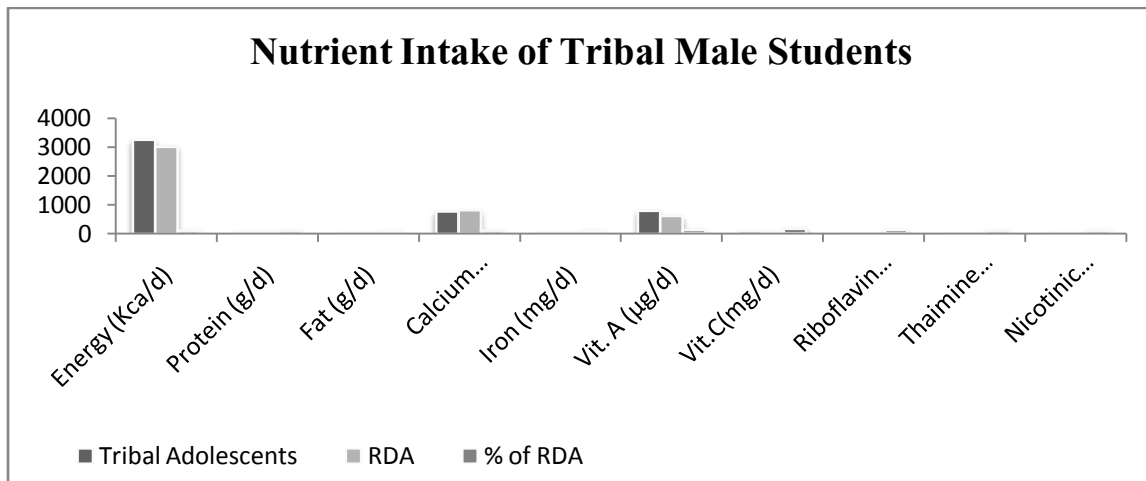


**Fig 6 – Food Consumption Pattern of Nontribal Female Students**

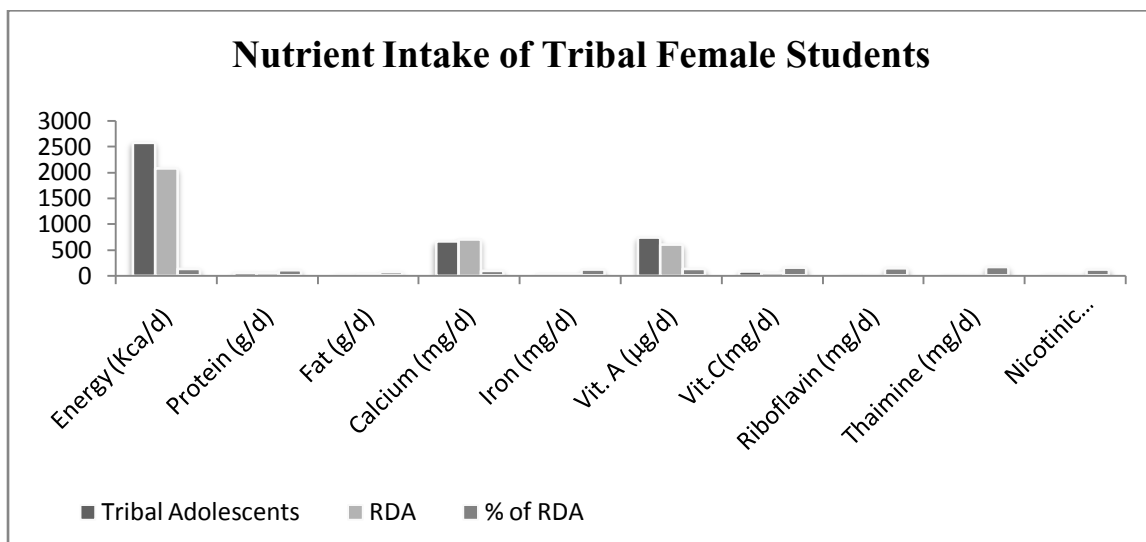
From the food composition table and the graphs, it is clear that tribal students take in more of cereals, green leafy vegetables, roots and tubers. Their consumption of fats, flesh foods and fruits are minimum. This may be due to the higher cost associated with these food groups which they can ill afford. On the other hand the non tribal students take in fewer amounts of vegetables, but compensate this with a higher consumption of fruits. The consumption of milk is also quite high in this population. They also take in a lot of flesh foods along with higher amounts of fats and sugar. This may also be the causative factor for the higher BMI levels seen in this group. As to how these food consumption pattern translates into nutrient intake is given in the following tables.

**TABLE: 4- NUTRIENT INTAKE OF TRIBAL & NON TRIBAL STUDENTS (MEAN)**

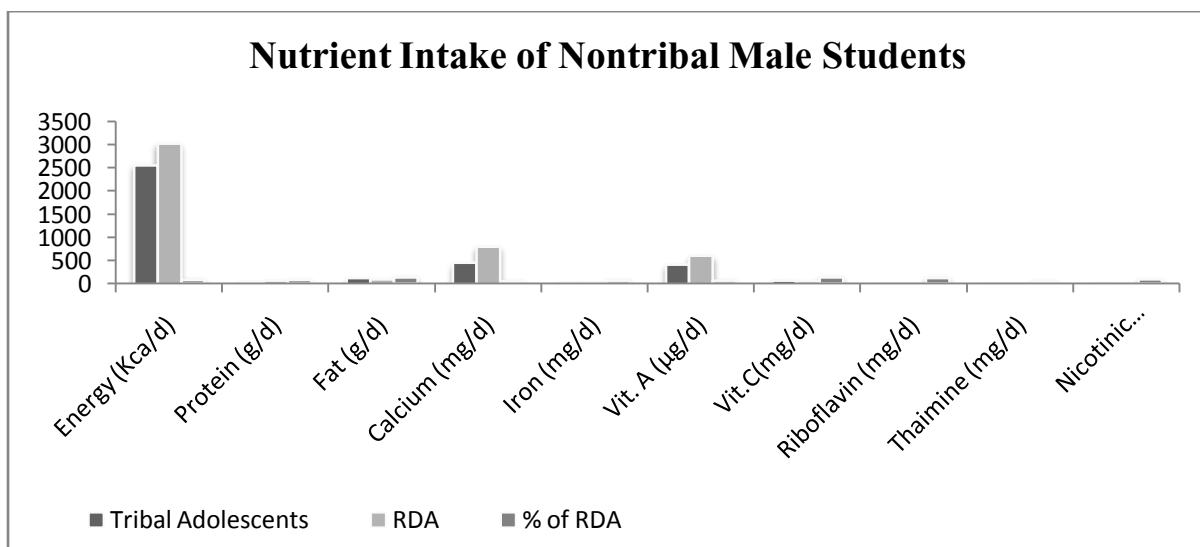
Group	Sex	Energy (Kcal/d)	Protein (g/d)	Fat (g/d)	Calcium (mg/d)	Iron (mg/d)	Vit. A (µg/d)	Vit. C(mg/d)	Riboflavin (mg/d)	Thiamine (mg/d)	Nicotinic Acid(mg/d)
Tribal Students	M	3245	55.2	18.4	765.9	25	789.6	78.5	2.1	1.4	18.1
	F	2569	51.2	15.1	654	28.5	732.1	76.3	1.7	1.6	16
RDA	M	3017	61.5	25	800	28	600	50	1.8	1.5	17
	F	2070	52.1	25	700	26	600	50	1.2	1	14
% of RDA	M	108	90	74	96	89	132	157	117	93	106
	F	124	98	60	93	110	122	153	142	160	114
Nontribal Students	M	2554	45.3	124	447	19.8	412	65.4	1.3	0.87	15.1
	F	1876	37.2	94	385	15.3	358	66.8	1.2	0.78	12.2
RDA	M	3017	61.5	94	800	28	600	50	1.1	1.5	17
	F	2070	52.1	99	700	26	600	50	1.2	1	14
% of RDA	M	85	74	132	56	71	69	131	118	58	89
	F	91	71	95	55	59	60	134	100	78	87



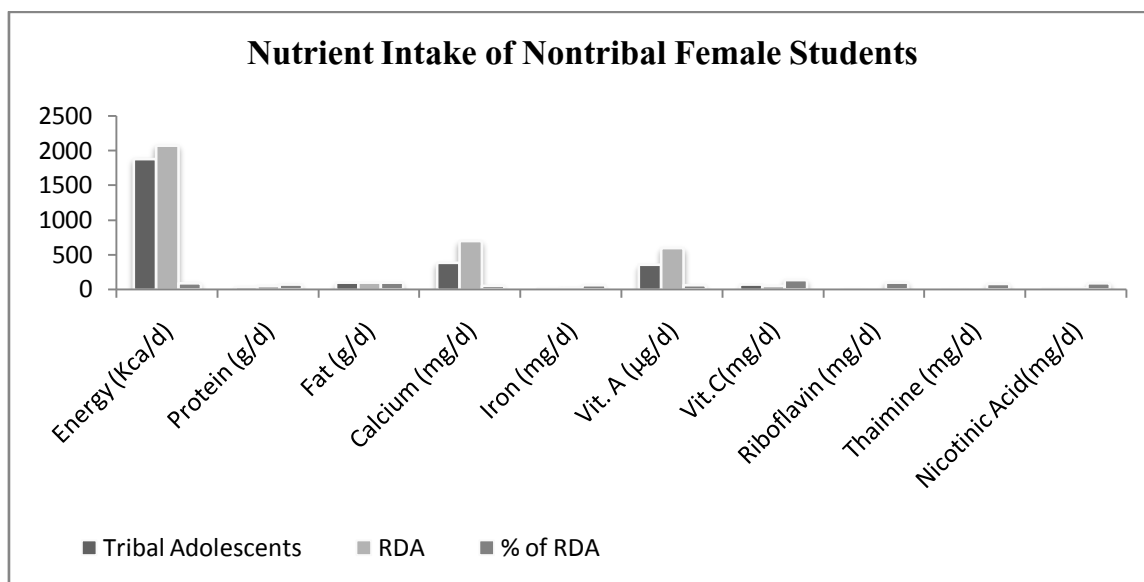
**Fig 7 – Nutrient Intake of Tribal Male Students**



**Fig 8 – Nutrient Intake of Tribal Female Students**



**Fig 9 – Nutrient Intake of Nontribal Male Students**



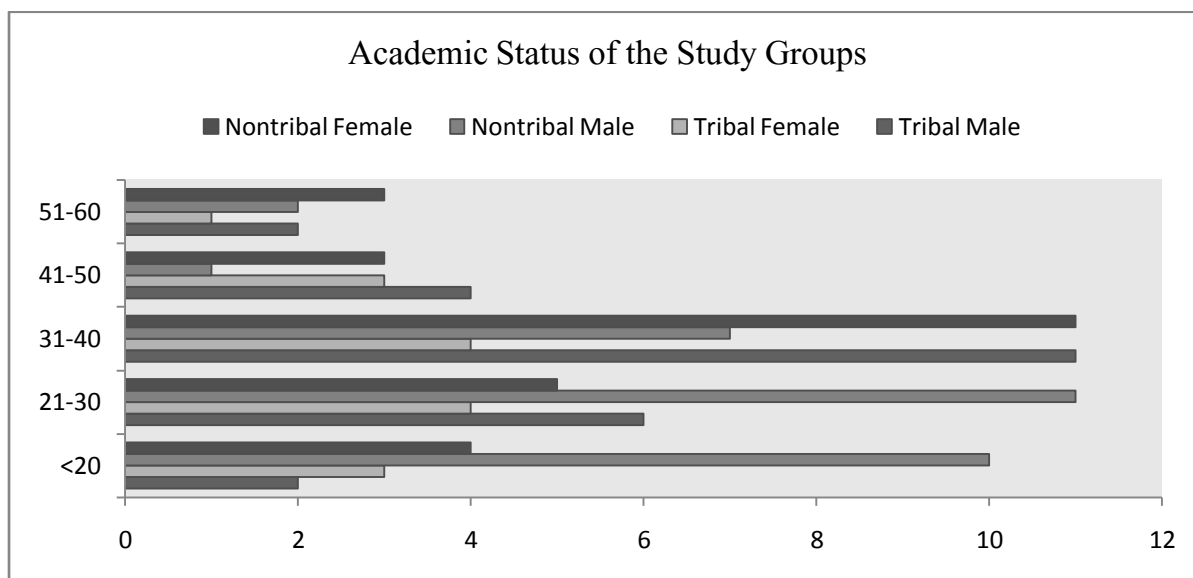
**Fig 10 – Nutrient Intake of Nontribal Female Students**

Thus the nutrient consumption table shows that the energy consumption of tribal students is slightly higher, but a major difference exists in the energy availability in the female students. While tribal female students have adequate energy consumption, the nontribal populace suffers from deficient energy consumption. This may due to food fads in females and also the influence of television or peer pressure to remain thin. The protein consumption levels are almost similar but fat intake is very less in the nontribal group. But then the levels of consumption of other minerals like calcium, iron and those of various vitamins are quiet high in the tribal group than in the nontribal population. This may be due to the intake of more of vegetables in the tribal group than the nontribal students.

**4.4 Academic Status**

**TABLE: 5- Category wise Percentage Achievement**

Category	<20	21-30	31-40	41-50	51-60	>60
Tribal Male	2	6	11	4	2	2
Tribal Female	3	4	4	3	1	Nil
Nontribal Male	10	11	7	1	2	Nil
Nontribal Female	4	10	6	3	3	1

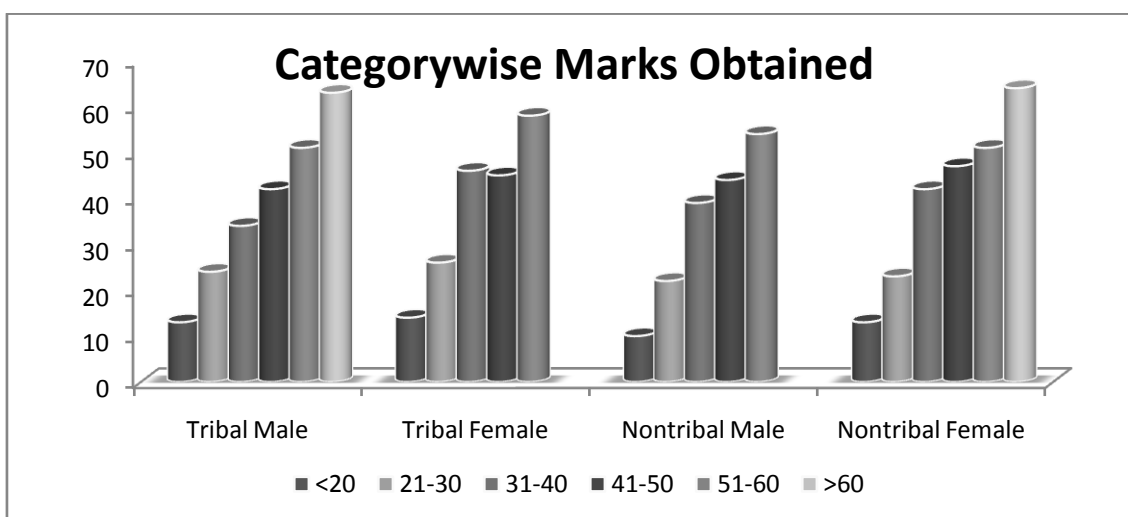




**Fig 11 – Academic Status of the Study Groups**

**TABLE: 6 Category wise Average Marks Obtained**

Category	Tribal Male	Tribal Female	Nontribal Male	Nontribal Female
<20	13	14	10	13
21-30	24	26	22	23
31-40	34	46	39	42
41-50	42	45	44	47
51-60	51	58	54	51
>60	63	Nil	Nil	64



**Fig 12 – Category wise Average Marks Obtained**

The data from the study was analyzed with the help of SPSS (version-10) software to find out the correlation between academic status of the students of the study group and the various factors, and also to develop regression equations to understand the degree of association between the various variables that affect the academic status of these students. They are detailed below:

i) The correlation coefficient between BMI and academic status was found to be 0.236 (R square value at 0.005 level of significance). Thus BMI levels are negatively correlated, albeit weakly with academic achievement.

The relationship can be better explained with the help of the following linear regression equation :

$$E = 159.92 - 0.486 B$$

$$SE (162.893) \quad (8.561),$$

Where, E = Academic Status of the study group, B = BMI of the study group and SE = standard error of estimate.

ii) The correlation coefficient between Energy consumption and academic status was found to be 0.025 (R square value at 0.005 level of significance). This denotes a weak but positive correlation between Energy consumption and academic status of the study group. The relationship can be better explained with the help of the following linear regression equation :

$$E = 28.349 + 0.158 EC$$

$$SE (15.786) \quad (0.006),$$

Where, E = Academic Status of the study group, EC = Energy consumption of the study group and SE = standard error of estimate.

iii) The correlation coefficient between Protein intake and academic status was found to be 0.109 (R square value at 0.005 level of significance). This denotes a weak positive correlation between Protein intake and academic status of the study group. The relationship can be better explained with the help of the following linear regression equation :

$$E = 22.191 + 0.330 P$$
$$SE \quad (19.734) \quad (0.414),$$

Where, E = Academic Status of the study group, P = Protein intake of the study group and SE = standard error of estimate.

### **Conclusion**

The above study shows that that, firstly, the tribal students have lower BMI values than their nontribal counterparts which may be due to dietary differences – tribal students have less access to convenience foods and as such may have less consumption of these type of empty calorie containing foods. Also the academic achievements of tribal students are a little lower than their nontribal counterparts which again come out in the regression and negative correlation of BMI with academic achievement.

The dietary survey shows that tribal students take in more of cereals, green leafy vegetables, roots and tubers. Their consumption of fats, flesh foods and fruits are minimum. This may be due to the higher cost associated with these food groups which they can ill afford. When these dietary survey data are converted to energy and nutrient consumption with the help of food composition tables it is seen that the energy consumption of tribal students is slightly higher, but a major difference exists in the energy availability in the female students. While tribal female students have adequate energy consumption, the nontribal populace suffers from deficient energy consumption. Consumption of other minerals like calcium, iron and those of various vitamins are also quite high in the tribal group. Statistical analysis of these nutrients consumption data with that of their academic achievement provides valuable insight into the role of various nutrients in academic achievement of these students. It was found that BMI and fat consumption levels are negatively correlated with academic achievement. Though the correlation of BMI with academic achievement is weak, fat consumption is strongly correlated with academic achievement. This may be due to the fact that fats form a crucial part of the neuronal circuitry. All other nutrients are positively correlated with academic excellence. Of the various vitamins, Vitamin C has the strongest correlation with academic status, followed by Vitamin A Riboflavin and Thiamine respectively. This correlation may be because, all these vitamins are particularly important for neuronal development as well as neuronal connectivity and signal processing and transmission. Thus from the above study and analysis of the data generated, we can conclude that nutritional status of a college student has definite relationship with his/her academic achievement.

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