ORIGINAL ARTICLE

Trends in consumption of fats and oils among Indian tribal population over a period of 30 years: Findings of National Nutrition Monitoring Bureau surveys

A Laxmaiah[1], N Balakrishna[2], N Arlappa[2], II Meshram[2], R Harikumar[2], K Mallikharjuna Rao[2]

[1]Scientist F & Head, Division of Community studies, National Institute of Nutrition, ICMR, Hyderabad; [2]Scientist D, ICMR, National Institute of Nutrition, ICMR, Hyderabad, India

Corresponding Author

Address for Correspondence: A Laxmaiah, Scientist F & Head, Division of Community Studies, National Institute of Nutrition, ICMR, Hyderabad, India.
E- Mail ID: avulalaxman@yahoo.com

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Abstract

Introduction: In several randomized control trials, it was observed that the dietary fat content has a little, but a significant effect on energy consumption and body weight. The purpose of this communication was to assess fat consumption among tribals, time trends and its association with obesity and hypertension. **Methods:** These were community based cross-sectional studies, adopted multistage random sampling procedure. The subjects were covered from 120 randomly selected villages each from 9 states in India. Information on household socio-economic & demographic and food intakes were collected. Anthropometric parameters and blood pressure were measured by using standard equipment and procedures. **Results:** The mean intake of food and nutrients were assessed in 14,324, 32,023, and 41507 tribal subjects in 1985-87, 1998-99 and 2008-09, respectively. The mean consumption of visible fats was 10g/CU/day, as against requirement of 20g and increased from 7g in 1985-87 to 10g in 2008-09. The percentage of energy obtained from total fat (20.8g/day) was 10% as against safe limit of 20%. The consumption of total dietary fats was increased significantly over a period of 3 decades in all the age groups, but it is less than recommended levels of ICMR. The fat intake was significantly associated with obesity and hypertension. **Conclusions:** Even though fat consumption was increased in all the age groups, but less than the recommended levels of ICMR. The consumption of fat was significantly associated with obesity and hypertension. There is an urgent need to create awareness among tribal population to consume adequate and quality of fats.

Key Words

Dietary fat; tribal population; time trends; recommended dietary allowance.

Introduction

It is projected that about 75% of all deaths and 60% of all disability adjusted life years (DALY) worldwide will be attributable to non-communicable diseases like cardiovascular diseases, type 2 diabetes, obesity, and cancers by 2020, with the largest increases and burdens in low and middle income countries rather than high income countries [1-2]. Most of these chronic diseases occur prematurely and can be prevented or delayed by making its visibility and targeting of the modifiable risk factors with greatest impact on these diseases. Generally, healthcare systems, clinicians, and scientists have focused on the medical, drug treatment models that highlight metabolic risk factors as established predictors of diseases rather than focusing on fundamental root causes like diet and healthy lifestyles [3]. Indeed, given that trends in metabolic risk factors such as blood pressure, cholesterol, glucose, and body mass index are being largely driven by nutrition, suboptimal diet is the single leading modifiable cause of poor health in the world [4].

Over the past several decades, multiple diet-disease relationships, establishing either beneficial or harmful effects of specific dietary fats, have been identified and been the target of major policy programmes. In particular, age and gender specific national consumption levels of these nutrients are essential for quantifying the impact on burdens of disease risk, which are not uniformly distributed across the population groups [5].

Fats and oils have an important place in human nutrition. These are major source of energy for body

and facilitate the absorption of many lipid soluble vitamins. The essential fatty acid deficiency results to reduced growth rate, phrynoderma, impaired reproduction, and susceptibility to infection [6]. Among many developing countries rising income levels and availability of cheap vegetable oils and fats in global market has resulted in increased fat consumption [7]. Studies indicate that a relative high intake of n6 fatty acids shifts the human physiologic state to one that is prothrombotic state characterized by increase in blood viscosity, vasospasm, and vasoconstriction and decreases in bleeding time [8]. Studies also indicate that the association between fat intake and overweight is not limited to the high-energy content of fatty foods; the ability to oxidize dietary fat is impaired in some individuals genetically predisposed to obesity [9].

The nutrition transition over the past 30 years (1973–2004), has resulted in a 7% decrease in energy derived from carbohydrates and a 6% increase in energy derived from fats [10]. Various studies indicated that nutritional transition is strongly associated with rising prevalence of chronic diseases among all segments of population [11-12].

Consumption of fats and oils is a matter of strong public interest due to their association with rising epidemic of obesity and Non Communicable Diseases (NCDs) among the Indian population. Though the increase in prevalence of overweight and obesity more significant in urban population, it is also slowly rising in tribal population. Evaluation of the trends of consumption of fats and oils among tribals is useful in understanding their role in development of obesity and related diseases over a period of time. Dietary food pattern analysis has increasingly been used to capture the complexities of diet and the risk of chronic diseases in adults, but limited information is available among tribal population.

Aims & Objectives

National Nutrition Monitoring Bureau (NNMB) has collected data on diet and nutrition status of tribal population in 3 time points since 1985-87. The present communication aims to present time trends of consumption levels of fats and oils, and its association with obesity and hypertension among the tribal population.

Material and Methods

Study design and study areas: The NNMB has carried out community based cross-sectional studies adopting multistage random sampling procedure in the Integrated Tribal Development Areas (ITDA) of 9 States in India viz., Andhra Pradesh, Gujarat, Kerala, Karnataka, Maharashtra, Madhya Pradesh, Orissa, Tamil Nadu and West Bengal.

Selection of Villages and Households: The required number of households were covered from 90 randomly selected old villages from each state from the list of villages already covered during the preceding two serial surveys viz., 1985-87, and 1998-99 and another 30 new villages were selected from the list of villages obtained from the Census 2001 for each state.

From each selected village, 40 households (HHs) were covered by adopting 'probability proportion to population size' (PPS) of different tribes. For this purpose, HHs were grouped according to the type of tribe and required numbers of HHs were covered continuously from each tribal group by selecting random start. Thus a total of 4800 HHs from each State were covered for the present study.

Data Collection: Information was collected from the subjects on pre-tested study instruments on various socioeconomic and demographic variables. Anthropometric parameters such as weight, height, waist and hip circumference were recorded on all the adult men and women who had 20 years of age and above by using standard equipment and procedure [13]. A one day 24-hour recall method of diet survey [14] was carried out in one fourth of the households covered for anthropometry from each state to assess food and nutrient intakes at household as well individual level. Blood pressure (BP) of all the available individuals on the study was recorded using mercury sphygmomanometer for 3 times at 5 minutes interval between each reading in recumbent position during 2008-09.

Ethical clearance: Ethical clearance was obtained from Institutional Ethical Review Committee. Written informed consent was obtained from all the subjects covered for the study. The study protocol was approved by Scientific Advisory Committee (SAC) of the Institute, constituted with the experts of Public Health, Nutritionists, physicians, pediatricians and biostatisticians.

Training and standardization: All the project staff consisting of medical officers, social scientists, anthropologists and nutritionists from 9 states were trained at National Institute of Nutrition (NIN), Indian Council of Medical Research, Hyderabad, in various survey methodologies to be adopted in the

present study and maximum care was taken to bring the intra and inter-individual variations at acceptable levels between the teams. Scientist from the National Institute of Nutrition (NIN) have carried out quality control checks and monitoring of data collection in sub-sample of the subjects.

Statistical Analysis: The data was scrutinized and checked for its consistence and enter into the computers and it was analysed by using SPSS (Window Version 19.0). Univariate and bivariate analysis was carried out. Hypertension or high blood pressure is defined as mean systolic blood pressure (SBP) 140 mmHg, mean diastolic blood pressure (DBP) 90 mm, or current treatment for hypertension with prescription medication. JNC VII criteria's are used for classification of hypertension [15]. Body mass index (BMI) is calculated as weight (kg)/ht. $(mt)^2$. BMI value of less than 18.5 is classified as chronic energy deficiency (CED), BMI between 18.5-24.99, as normal and BMI ≥ 25-29.9 as overweight and ≥ 30 as obese [16]. Waist circumference of ≥102 cm in males and ≥ 88 cm in females were classified as having abdominal obesity [17]. Waist hip ratio of ≥0.95 for males and ≥0.80 for females are classified as having central obesity [18]. Intake of food and nutrients including fat among all the age groups was assessed by using 'Nutritive values of Indian foods [19]. Association between fat intakes and hypertension and obesity was assessed.

Results

A one day 24-hour recall method of diet surveys were carried out in 3460, 8036 and 10077 households during 1985-87, 1998-99 and 2008-09, respectively. The mean food and nutrient intakes were assessed in 14324, 32023, and 41507 tribal subjects in the above 3 periods of the survey, respectively [Table 1]. Due to some logistic problems and frequent project staff turnover, a significant variations observed in the coverage of households and subjects from state to state.

Fat intake at households: The current mean consumption of visible fats was 10g/CU/day as against the requirement of 20g and it increased from 7g in1985-87, through 8g in 1998-99 to 10g in 2008-09. Even though the consumption levels were less than the recommended dietary allowance (RDA), it gradually increased from 35% of RDA in 1985-87 through 45% in 1998-99 to 50% in 2008-09. A similar trend was observed in the intake of total fat viz., visible and invisible fat (42.5% to 45%). The percentage of energy obtained from total fat (18g/day) was 10%, as against safe limit of 20% [Table 2].

Differences in consumption by states: In 2008-09, mean visible fat intake among tribal population was maximum in the states of Maharashtra (15g/CU/day), Karnataka, Andhra Pradesh and Gujarat (14g/CU/day) as against the recommended level of 20g/CU/day and lowest in the states of Orissa, Madhya Pradesh and West Bengal (6-8g/CU/day). However, the consumption levels were significantly increased over a period of time in all the states, except for the states of Orissa and West Bengal [Table 2].

The fat intakes were higher in all the age and gender groups in the states of Maharashtra (9.2-18g/day) and Andhra Pradesh (6.3 – 16g/day) as compared to other states like Madhya Pradesh (3-7g/day), Kerala, Orissa, and West Bengal (3-8g/day) [Table 3].

However, the total (visible and invisible) fat intakes were higher in all the age and gender groups in the states of Kerala (9 in 1-3 years to 30g/day in men), Gujarat (14g in 1-3 years to 29g/day in men) and Maharashtra (9g in 1-3 years to 27g/day in men) as compared to other states like Orissa and West Bengal (4-9g/day) [Table 4].

Differences in consumption of fats by age, gender and physiological groups: The current mean consumption of visible fats was only 4g/day among 1-3 year children (15% of RDA) to 11g/day in adolescent boys (24% of RDA) and sedentary men (44%) as against the requirement of 27-50g/day. However, the consumption of fat is increased marginal over a period of 3 decades from 3-9g/day in1985-87 to 4-11g in 2008-09. The percent of RDA deficit was observed maximum among children (76-85%), adolescents (74-82%) and lactating mother (70%) compared to men and women (55-56%). The consumption of total dietary fats was also increased significantly over a period of 3 decades in all the age groups, but it is less than recommended levels of ICMR [Table 5].

Association between energy levels derived from fat intakes and prevalence of obesity and hypertension: The prevalence of hypertension was significantly ($p < 0.004$) higher among men (23.2%), who consume fat in higher percentiles as compared to the consumers of fat in lower percentiles (21.4%), while a reverse trend was observed among women [Table 6]. Similarly, the prevalence of hypertension was significantly higher among men (26.6%), who

consumed higher energy (>20% of energy) from the dietary fats as compared to the individuals (20%) who consumed lower energy (<15% of energy). This observation was not found in women.

The prevalence of overweight and obesity (BMI ≥25) was significantly higher in men (16%) and women (22%) who are consuming more energy from the total fats (≥ 20% of energy) as compared to energy consumed <15% of energy from total fats by men (8.4%) and women (12%). Similarly, the prevalence of abdominal obesity was higher among men (22%) and women (31%) who consume high energy (>20% of energy) as compared to men (11%) and women (20%) who consume less energy (<15% of energy) from fats.

The prevalence of central obesity was higher among men (56%) who consume high energy (>20% of energy) as compared to men (51%) who consume less energy (<15% of energy) from fats.

Discussion

This systematic investigation of individual dietary assessments across the states provides, for the first time, quantitative estimates of the consumption of major dietary fats and oils by state, age, gender and physiological groups. Since suboptimal diet is the single leading cause of death and disability in the world today [20], these findings are highly relevant and of crucial interest to the scientific community, health professionals, and policy makers. The results demonstrate both similarities and substantial diversity in consumption of fats and oils across the states. These findings facilitate quantitative assessment of disease burdens attributable to these dietary fats, especially non-communicable diseases. We also assessed time trends in consumption of dietary fats over a period of 30 years, although some change estimates should be interpreted with caution due to coverage of small sample size covered in the earlier surveys (1985-87).

At a national level, mean consumption of visible fat was 10g/CU/day as it contributing 10% to the total energy from the fats as against the safe limit of <20% of energy, which is in line with current recommendations. Lowest intakes were identified in the states like Orissa, Madhya Pradesh and West Bengal. Such low fat intakes would be beneficial against coronary heart diseases, especially obesity and hypertension [21]. The low intake of fats and oils are suggesting that infrequent use of vegetable oils for cooking or preparing foods may be due to poverty and inaccessibility. However, the consumption patterns over a period of 3 decades revealed that the intakes have increased. The minimum quantity of fat consumption is essential to meet various biological needs of the body. However, the quality of fat intake is mostly important rather than focusing quantity alone. The consumption of saturated fat should not be more than 10% of energy getting from these fats; otherwise, it gives ill-effects on cardiovascular health and similarly, the intake of trans fats should not increase 1% of energy. In this direction, several high income countries have recently established national or sub-national policy efforts to reduce trans fat consumption [22-23] but the data on trans fat was not available at country level. These findings suggest substantial heterogeneity across the states. Relatively few states had the mean intakes even <5% of energy, may not sufficient to meet even biological needs of the tribal population in some of the states. Relatively, highest consumption was observed in the states of Maharashtra, Gujarat, and Andhra Pradesh. Differences by age were evident for fat consumption with highest consumption at men and women of 18 years and above compared to young children, perhaps because of better consumption in terms of quantity and quality of foods compared to children [24]. Age differences were seen for dietary fat with higher intakes at older ages.

Conclusion

Several epidemiological studies and clinical trials have documented the health benefits and harms of specific dietary fats and oils. Yet, far less progress has been achieved in understanding the patterns of national consumption as well as heterogeneity by states, age, sex, and time. Our results revealed at household and individual-level, regional/state representative dietary data, provides a systematic and comprehensive quantitative assessment of the national level consumption of dietary fats and oils. The present study revealed that the intakes of dietary fat are low in all the states, among all age, gender and physiological groups. It may draw attention of the national/state governments, NGOs who are working in the field of health and nutrition of tribals, may encourage or provide more and more qualitative fats and oils to this population.

Recommendation

These findings permit detailed investigation of the impact of dietary habits on disease burdens across states, of the correlates and drivers of current

dietary intakes and nutrition transitions over time, and of the impact of national policies and interventions that nationally or regionally may alter population dietary intakes. These results inform national and global efforts to alter diet, reduce disease, and improve population health. Our findings also highlight specific data gaps and provide a framework for future dietary surveillance using validated, standardized, nationally representative surveys supported by appropriate food composition data. Understanding the national patterns and impact of suboptimal dietary habits is essential to inform, implement, and evaluate specific interventions and policies to reduce disease burdens and disparities around the nation. Unhealthy diet is the single leading modifiable cause of poor health in many countries. Multiple diet-disease relationships, establishing either beneficial or harmful effects of specific dietary fats, have been identified. Most estimates of dietary fats and oils have relied largely on crude expenditure data, and only few countries have been collecting nationally representative data on consumption of major dietary fats and oils.

This systematic investigation of individual-level dietary assessments across the nation provides quantitative estimates of the national consumption of major dietary fats and oils by states, age, and gender and physiological groups. The findings facilitate quantitative assessment of disease burdens attributable to these dietary factors and can be used to inform national and state efforts to alter diet, reduce disease, and improve population health [25]. Our findings highlight the need for establishment of systematic surveillance and monitoring of key dietary habits nationally and especially in the states where systematic dietary data is not available. There is a due for conduction of another round of diet and nutrition data collection (4th series) in almost all the states during 2015-16 in a representative population.

Limitation of the study

The dietary data was collected in 3 serial studies in different time points, however, a significant of variation in the consumption of diet was observed over a period of time. Recent reports revealed that more and more processed and ready to eat food is being consumed by various population groups. There is a chance to under reporting of consumption of these foods and we do not have the nutritive values for many ready to eat and packed foods. Therefore, there is chance to under reporting of the dietary fat as compared to actual consumption by the individual. However, this may not be true, because, the tribal population generally belongs to low socioeconomic group, accessibility and affordability to have these foods is minimal. Therefore, they unlikely to consume significant amount of pre-cooked, ready to eat and processed foods. Even though, the present study carried out in a 75% of Indian representative tribal population, the dietary data is not available for the population who are living the North Eastern and Northern States. At baseline studies (1985-87), in some of the states, the sample size covered is low, because of many logistic and project staff frequent turnover. Since, the diet of the tribals is so monotonous (low diversity), carrying out diet surveys even in 100 households per state is enough to represent the dietary intakes of tribal population.

Relevance of the study

Our investigation has several strengths. A systematic diet survey was pioneered and developed an appropriate one day 24-hour recall method of survey at National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, India [14]. The same methodology is being used nationally and internationally in many countries and the same was used in the present study to assess food and nutrient intakes at household (g/CU/day) as well as individual level consumption by age, gender, and various physiological groups.

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Tables

TABLE 1 COVERAGE PARTICULARS OF 24 HOUR RECALL METHOD OF DIET SURVEYS IN TRIBAL HOUSEHOLDS IN 9 STATES IN INDIA

State	No. villages covered in India	No. of 24 hour recall diet surveys					
		No. of households covered			No. of subjects covered		
		1985-87	1998-99	2008-09	1985-87	1998-99	2008-09
Kerala	120	330	1140	1197	1156	3914	3798
Tamil Nadu	120	170	956	1162	656	3340	4055
Karnataka	120	270	801	1065	1096	3597	4515
Andhra Pradesh	120	900	739	1188	3620	2458	4385
Maharashtra	120	300	940	1175	1129	4046	5628
Gujarat	120	820	950	1197	3255	3489	5143
Madhya Pradesh	120	-	799	1186	-	4147	5692
Orissa	120	400	1084	1195	1890	4690	5352
West Bengal	72	270	627	712	1222	2342	2939
Pooled	1032	3460	8036	1007	14324	32023	41507

TABLE 2 MEAN CONSUMPTION OF DIETARY FATS AND OILS (G/CU/DAY) AND TIME TRENDS AMONG TRIBAL POPULATION IN 9 STATES OF INDIA

States	1985-87		1998-99		2008-09	
	Visible fat g/CU/day	Total fat g/CU/ day	Visible fat g/CU/day	Total fat g/CU/ day	Visible fat g/CU/day	Total fat g/CU/day
Kerala	3	9	6	17	9	26
Tamil Nadu	6	13	8	17	12	16
Karnataka	8	26	6	22	**4**	22
Andhra Pradesh	10	21	7	15	14	20
Maharashtra	7	14	12	23	15	22
Gujarat	12	22	15	28	14	30
Madhya Pradesh	-	-	4	14	7	12
Orissa	4	10	6	15	6	10
West Bengal	5	9	11	18	8	11
Pooled	7	17	8	19	10	18
RDA	20	40	20	40	20	40
% of RDA	35	42.5	40	47.5	50	45
% of deficit	65	57.5	60	52.5	50	55

* CU: Consumption Unit RDA: Recommended dietary Allowance

TABLE 3 MEAN CONSUMPTION OF FATS AND OILS (G/PER DAY) BY AGE AND GENDER GROUPS OF TRIBAL POPULATION IN 9 STATES IN INDIA: NNMB TRIBAL SURVEYS 2008-09

State	1-3 years	4-6 years	7-9 years	10-12 years		13-15 years		16-17 years		≥18 years	
	B+G	B+G	B+G	Boys	Girls	Boys	Girls	Boys	Girls	Men	Women
Kerala	3.0	4.1	5.0	4.9	5.2	5.4	6.1	6.9	6.1	7.7	8.2
Tamil Nadu	4.4	6.0	6.6	7.6	7.0	8.9	8.9	10.5	9.6	13.3	11.5
Karnataka	1.6	2.2	2.9	5.0	3.0	4.1	3.3	3.1	2.6	3.3	3.3
Andhra Pradesh	6.3	8.5	9.9	10.1	11.3	12.9	11.8	15.6	12.3	15.3	12.5
Maharashtra	6.2	9.2	11.3	12.7	12.5	15.0	12.8	17.1	14.9	17.5	14.8
Gujarat	6.0	7.8	8.8	9.5	9.5	10.5	10.2	12.0	10.9	14.2	12.9
Madhya Pradesh	3.4	4.5	5.2	5.5	4.8	5.4	5.4	5.6	6.3	6.9	6.4
Orissa	3.0	4.0	3.9	4.4	4.2	5.0	5.2	6.1	5.1	7.5	6.1
West Bengal	3.1	4.2	6.1	5.0	5.4	7.6	6.2	5.6	5.5	7.3	8.1
Mean	4.3	5.9	7.0	7.2	7.2	8.4	7.7	9.9	8.3	10.1	7.9
RDA	27	25	30	35	35	45	40	50	35	20	20
% of Deficit	84	76	77	79	79	79	79	80	76	50	60

CU: Co-efficient Unit B: Boys G: Girls NA: Not Available

TABLE 4 MEDIAN CONSUMPTION OF TOTAL (VISIBLE AND INVISIBLE) FATS (G/PER DAY) BY AGE AND GENDER GROUPS OF TRIBAL POPULATION IN 9 STATES IN INDIA: NNMB TRIBAL SURVEYS 2008-09

State	1-3 years	4-6 years	7-9 years	10-12 years		13-15 years		16-17 years		≥18 years	
	B+G	B+G	B+G	Boys	Girls	Boys	Girls	Boys	Girls	Men	Women
Kerala	9.1	12.6	16.2	14.9	17.4	20.3	22.5	21.1	21.7	30.1	26.6
Tamil Nadu	6.3	8.4	9.3	10.1	9.9	11.2	11.2	13.6	13.7	18.4	14.7
Karnataka	8.3	10.9	14.6	15.7	13.9	17.2	14.9	19.1	16.8	22.9	21.4
Andhra Pradesh	9.1	12.1	13.6	14.3	15.5	17.4	15.9	18.3	18.3	20.5	18.0
Maharashtra	9.2	13.2	16.2	18.2	17.9	20.9	17.7	25.2	19.7	24.7	19.9
Gujarat	14.2	17.5	20.7	20.3	21.1	22.9	22.7	24.3	23.4	28.9	27.0
Madhya Pradesh	5.1	7.7	9.5	10.6	9.7	10.8	9.7	11.2	12.4	12.2	11.6
Orissa	4.5	6.0	6.3	7.0	7.2	8.2	8.0	9.4	9.4	10.2	9.2
West Bengal	4.4	6.3	6.4	7.0	6.8	8.8	9.6	8.9	7.7	8.7	8.6
Pooled	7.1	10.1	11.8	12.4	12.3	14.6	13.7	17.3	15.2	19.9	18.1

TABLE 5 TIME TRENDS IN MEAN CONSUMPTION OF VISIBLE AND INVISIBLE FATS (G/PER DAY) BY AGE, GENDER AND PHYSIOLOGICAL GROUPS OF TRIBAL POPULATION IN 9 STATES IN INDIA

Age (years)	Gender/Physiological groups	Fat consumption levels (g/per day) in 3 Serial tribal surveys							
		1985-87		1998-99		2008-09			
		Visible fat	Total fat	Visible fat	Total fat	Visible fat	Total fat	RDA for visible fat	% of RDA deficit (based on visible fat intake in 2008-09)
1-3	Boys +Girls	3	6	4	9	4	8	27	85
4-6	Boys +Girls	5	8	5	11	6	11	25	76
7-9	School age children	4	7	6	13	7	12	30	77
10-12	School age girls	6	11	6	14	7	12	35	80
10-12	School age boys	5	9	6	14	7	12	35	80
13-15	Adolescent boys	5	9	6	16	8	15	45	82
13-15	Adolescent girls	5	9	6	16	8	14	40	80
16-17	Adolescent boys	6	10	8	18	11	18	50	78
16-17	Adolescent girls	7	12	7	17	9	16	35	74
≥ 18	Men (sedentary)	6	11	8	24	11	20	25	56
	Women (sedentary	7	14	7	24	9	18	20	55
	Pregnant women	9	16	10	20	10	18	30	33
	Lactating mother	8	13	11	22	9	17	30	70

Total fat = Visible and Invisible fat

TABLE 6 ASSOCIATION BETWEEN HYPERTENSION AND LEVEL OF TOTAL FAT CONSUMPTION

Gender	Variable	N	Normal	Hypertension	p value
Fat consumption (g/CU/day)					
Men	1st Tertile	3431	78.6	21.4	0.002
	2nd Tertile	3458	80.1	19.9	
	3rd Tertile	3441	76.8	23.2	
Women	1st Tertile	4388	77.6	22.4	0.028
	2nd Tertile	4421	79.6	20.4	
	3rd Tertile	4419	79.6	20.4	

TABLE 7 ASSOCIATION BETWEEN LEVELS OF ENERGY CONSUMPTION THROUGH DIETARY FAT AND HYPERTENSION AND OBESITY

Gender	variable	N	% Energy consumed from dietary fat			
			<15	15-20	≥20	p value
Hypertension						
Men	Normotensives	8151	80.0	77.7	73.4	
	Hypertensives	2235	20.0	22.3	26.6	0.0001
Women	Normotensives	10495	79.1	78.0	78.9	NS
	Hypertensives	2812	20.9	20	21.1	
General obesity (BMI ≥25)						
Men	CED (BMI <18.5)	3570	36.3	34.3	27.9	0.0001
	Normal BMI 18.5-<25.0	5711	55.4	53.5	56.4	
	Overweight/Obesity (BMI≥25)	1066	8.4	12.2	15.7	
Women	CED (BMI <18.5)	4585	37.8	30.8	27.8	0.0001
	Normal BMI 18.5-<25.0	6710	50.3	51.7	50.5	
	Overweight/Obesity (BMI≥25)	1957	11.9	17.5	21.7	
Abdominal Obesity						
Men	Normal	8931	89.0	83.6	77.7	0.0001
	Abdominal obesity	1440	11.0	16.4	22.3	
Women	Normal	10194	79.9	73.6	69.1	0.0001
	Abdominal obesity	3093	20.1	26.4	30.9	
Central obesity						
Men	Normal	5016	48.8	50.4	44.5	0.001
	Central obesity	5355	51.2	49.6	55.5	
Women	Normal	4851	35.4	38.2	38.6	0.002
	Central obesity	8433	64.6	61.8	61.4	