Original Article

Consumption of fruits, vegetables and salt in the context of control of type 2 diabetes and hypertension in Kerala, India

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Abstract

Background: Proper diet is necessary to control hypertension and diabetes. This paper describes the combined fruit and vegetable, and salt intake of adults (>=18 years) who were detected to have hypertension or diabetes. **Methods:** We analysed the data from a state-wide survey of 12012 adults using the World Health Organization STEPs for NCD risk factor surveillance. We evaluated the recommended intake of fruit and vegetable (>=5 servings/day) and salt (<5 gm/day) across participants divided into four strata, and the probabilities were also estimated using the fitted multiple binary logistic regression models. **Results:** Overall, 13.9% (95%CI: 12.2%-15.9%) and 29.4% (95%CI: 28%-30.8%) of participants consumed the recommended level of fruit and vegetable, and salt, respectively. Adjusted odds ratios were not significantly different across the four strata based on the status of treatment and control of diabetes or hypertension. The likelihood of following the recommended fruit and vegetable intake was highest for 50-69-year-old females with above high school education, obese, under treatment for diabetes or hypertension, and had normal values of FBS and BP (0.28). The likelihood for recommended salt intake was highest for 50-69-year-old males with above high school education and had normal BMI, under treatment for diabetes or hypertension, and had normal values of FBS and BP (0.69). **Conclusion:** The status of diabetes or hypertension did not show considerable influence in the fruit, vegetable, and salt intake of adults in general. A detailed exploration of the accessibility and acceptability of such recommended intakes in the Kerala context is warranted.

Keywords: Control, dietary intake, hypertension, Type 2 diabetes

Introduction

As per the global burden of disease study, in 2016, higher percentages of diabetes were observed in the southern states of Kerala and Tamil Nadu (>=10.5%).[1] The recently published National Noncommunicable disease Monitoring Survey (NNMS) reported an overall prevalence of raised blood glucose level as 9.3%, with 14.4% in Urban and 6.9% in Rural. Similarly, the raised blood pressure also showed a rural-urban difference with an overall prevalence of 28.5% (Urban- 34%; Rural 25.7%).[2] Studies from Kerala showed that the prevalence of type 2 diabetes was high (12% -16%) in urban areas even 20 years ago.[3,4] A geographical variation in the prevalence of diabetes also had

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been observed in studies, notably coastal regions reported low prevalence (2.5% in 2000 and 7.4% in 2017).[3,5]

A state-wide sample survey conducted in 2016-2017 in Kerala showed that, on an average, nearly one third and one fifth of adults had hypertension and diabetes respectively.[6] However, only 12.4% of individuals with diagnosed hypertension and 15.3% of individuals diagnosed with diabetes achieved adequate blood pressure and blood sugar control. Among those who were under treatment (self-reported), the satisfactory level of fasting blood sugar (FBS) and blood pressure was achieved by 32.7% and 35%, respectively.[6] A study among 1200 randomly selected patients from a diabetes care centre showed that only less than one-third of patients had their HbA1C at or below 7%.[7] A meta-analysis on hypertension in India demonstrated that one-tenth of rural and one-fifth of urban Indian hypertensive population had their BP under control.[8]

Self-care activities such as regular monitoring of blood sugar and blood pressure, adherence to proper dosage of medication, lower salt intake and a diet rich in fruits and vegetables and maintaining physical activity are crucial for hypertension and diabetes management.[9,10] However, dietary practices do not differ between people with and without diabetes and or hypertension in many populations.[11]

Since a significant proportion of the adult population in Kerala is diabetic or hypertensive and the control rates are abysmal, it will be helpful to explore the pattern of fruit, vegetable and salt consumption by the adults already detected to have hypertension and diabetes. Hence, this paper tries to explore whether the status of diabetes, hypertension and its control influence the combined fruit and vegetable, and salt consumption of adults, using state representative data. It also attempts to estimate the likelihood of adhering to the recommended level of fruit and vegetable, and salt intake by individuals with different characteristics while considering the status of diabetes or hypertension.

Subjects and Methods

Study participants

The data used for this analysis were from a state-wide cross-sectional survey among 12012 adults (>=18 years) based on the World Health Organization STEPs approach to NCD risk factor surveillance.[12] The survey was conducted from October 2016 to March 2017 in all 14 districts of Kerala. The details of the study and the sampling strategy were described earlier.[6,13] The local self-government institutions, such as municipal corporations and municipalities in urban areas and grama panchayaths in rural areas were the primary sampling units. We used a multi-stage cluster sampling method to select 600 urban wards (divisions of municipal corporations/municipalities) and 740 rural wards (divisions of grama panchayaths) for the survey. We randomly identified one cluster of 8 households from the list of households for each division. Participants were in the age group of 18-69 years, and one participant from each household was selected using KISH method.[14]

Ethical consideration

The institutional ethics committee approved the study protocol before the commencement of the survey. All participants were informed about the study and had given written informed consent.

Measurements

SECA 213 stand-alone stadiometer was used to measure the height (in cm), and a portable SECA 803 battery-operated electronic weighing scale (in Kg) was used to measure the weight of the participants. The systolic blood pressure (SBP) and diastolic blood pressure (DBP) (in mm Hg) were measured using OMRON HEM-7120 battery operated automatic blood pressure monitors. The fasting blood glucose level was estimated using point of care glucometers (One-touch ultra-easy, Johnson & Johnson). Physical activity levels were assessed using the global physical activity questionnaire (QPAQ).[15] Using showcards, the participants were asked about how many days they eat fruits/vegetables in a typical week and the number of servings of fruit/vegetable they eat on one of those days. A spot urine sample of 20 ml was collected from each participant, and urinary sodium was analysed in an accredited central laboratory.

Outcome variables

For each participant, the average fruit intake per day was estimated using the number of days they eat fruits in a typical week multiplied by the number of servings of fruit they eat on one of those days and then divided by seven. In the same way, the average vegetable intake per day was estimated for each participant. The number of servings of fruits and vegetables per day was calculated by taking the sum of average fruit and vegetable intake per day and categorized into < 5 servings perday or >=5 servings perday as per the WHO recommended standards.[16]

The 24-hour urinary intake of sodium was estimated using the modified Kawasaki formula, and it was multiplied by 2.54 to estimate the 24-hour intake of NaCl.[17-19] Further, we categorized the salt intake into <5 g/day or >=5 g/day as per the WHO guidelines.[16]

Exposure variables

We created three variables, each of which had four categories using the following criteria.

By considering the values of fasting blood sugar and whether the participant was under treatment for diabetes (self-reported), we created four categories such as the participant was 1) not under treatment for diabetes, and FBS was normal 2) not under treatment for diabetes, and FBS was above normal (>=126 mg/dl) 3) under treatment for diabetes, and FBS was normal 3) under treatment for diabetes and FBS was above normal.

Similarly, we created four categories by considering the values of systolic and diastolic blood pressure and whether the

participant was under treatment for hypertension (self-reported). The four categories were: the participant was 1) not under treatment for hypertension, and his/her SBP and DBP were normal (SBP < 140 & DBP < 90), 2) not under treatment for hypertension but his/her SBP or DBP was above normal, 3) under treatment for hypertension and had a normal SBP and DBP and 4) under treatment for hypertension and his/her SBP or DBP was above normal.

Further, we combined the above two variables and created a new variable with four categories such as the participant was 1) not under treatment for diabetes and hypertension, and both FBS and, SBP/DBP values were normal, 2) not under treatment for diabetes and hypertension but FBS or SBP/DBP values were above normal, 3) under treatment for diabetes or hypertension, and FBS and SBP/DBP values were normal and 4) under treatment for diabetes or hypertension, and FBS or SBP/DBP values were above normal.

Statistical analysis

Statistical analysis was done using Intercooled STATA (Statistical Software: Release 14, College Station, TX: Stata Corp LP). The weighted analysis was done to derive estimates, where the sample weights were calculated by taking the inverse of the product of probabilities based on the inclusion of individuals at various stages of sample selection. Variance inflation for cluster correction was also applied while estimating standard errors and confidence intervals.

We used multiple binary logistic regression analysis to estimate the adjusted odds ratios and confidence intervals for the outcome across the four categories of exposure variables considering the first category as the reference group.

The other variables included in the regression model were sex (male/female), age group (categorized into 18-35, 36-49 and 50-69), education (up to primary/secondary to high school/above high school), BMI category (normal (BMI below 25), overweight (25-29.99), obese (30+)), physical activity (recommended level (>=600 MET-minutes per week), less than recommended level (<600 MET-minutes per week).

After fitting the multiple logistic regression models, we used the "margins" commands in STATA to estimate the likelihood of following are recommended intake of fruit and vegetable and salt intake with respect to the status of diabetes and hypertension control among people with different characteristics.

Results

The background factors in connection with fruit, vegetable and salt intake

Table 1 describes the combined fruit and vegetable intake and salt intake across different characteristics of participants. The consumption of five or more daily servings of fruit and vegetable was 14%, and consumption of less than five grams of salt was 29% among participants. The recommended level of salt intake was significantly low among females than males (18% Vs 49%).

Compared to the young participants, five or more daily servings of fruit and vegetable intake was slightly high among 50-70 years old participants. A considerably higher proportion of elders consumed

Table 1: Combined Fruit and vegetable, and salt intake among participants with different characteristics

Variables	Fruit and vegetable intake >=5 servings per day				Salt intake <5 gm per day			
	Total participants N*	Followed recommended intake n	Weighted percentage and 95% confidence Interval		Total participants N*	Followed recommended intake n	Weighted percentage and 95% confidence Interval	
Total	11125	1579	13.9	12.2-15.9	11599	3308	29.4	28.0-30.8
Sex								
Male	4168	565	13.6	11.6-15.8	4299	2031	48.7	46.4-51.0
Female	6955	1014	14.2	12.3-16.3	7300	1277	18	16.6-19.5
Age group								
18-35	3713	487	12.4	10.4-14.6	3769	932	24.6	22.6-26.7
36-49	3640	495	12.2	10.3-14.3	3805	917	26.2	24.1-28.3
50-70	3772	597	17.2	14.7-20.0	4025	1459	37.1	35.0-39.3
Education								
Up to primary	2613	349	13.5	11.1-16.3	2821	884	32.5	29.8-35.3
Secondary to high school	5541	756	14	12.0-16.3	5754	1552	28.3	26.5-30.2
Above high school	2971	474	14.2	12.1-16.7	3024	872	28.6	26.4-30.6
BMI Category								
Below 25	6562	894	12.9	11.1-15.0	6886	2281	34.3	32.4-26.5
Overweight	3379	498	14.9	12.5-17.7	3577	864	24.4	22.4-26.5
Obese	1071	175	17.5	13.9-21.6	1136	163	13.5	10.9-16.5
Physical activity								
Recommended	8524	1287	14.3	12.4-16.3	8915	2465	29	27.4-30.5
Less than recommended	2601	292	12.9	10.4-15.7	2684	843	31.1	28.4-33.8

*The total participants were 12012, however due to missing observations, N is different for both outcome variables

less than five grams of salt per day (37% in 50-70 years Vs 25% in 18-35 and 26% in 36-49 years old). Fruit and vegetable intake and salt intake did not show much variation between people with different levels of education or physical activity. The recommended daily intake of fruit and vegetable was relatively high among people who were obese. Still, the recommended level of salt intake was low among them (14% in obese Vs 34% among those with BMI < 25).

Status of diabetes and hypertension VS fruit, vegetable and salt intake

The recommended intake of fruit and vegetable and salt showed a similar pattern across the four strata of the exposure variables defined in terms of diabetes, hypertension and both conditions [Table 2]. The proportion of daily intake of five or more servings of fruit and vegetable was slightly high but not satisfactory among those on treatment of diabetes or hypertension with adequate control as compared to other three strata (20.1% VS 13.8%, 12.9% and 15%). Similarly, the proportion of recommended daily intake of salt was relatively low among those who were not on treatment and had normal values of FBS, SBP and DBP (27% VS 32.3%, 34.9% and 33.3%).

The multiple logistic regression models showed highly significant *P* values for the likelihood ratio tests ($P < 0.001$). The odds ratios for recommended fruit and vegetable intake were not significantly different across the four strata while considering diabetes and hypertension alone.

However, while considering both conditions, odd ratios suggested that those who had above normal levels of FBS, SBP or DBP had 20% fewer odds of eating recommended level of fruit and vegetables [Table 3].

The salt intake did not show significant variation across four strata while considering diabetes alone for classifying the categories. However, the odds of recommended salt intake were 1.6 times higher among those who were under treatment for hypertension and keeping their blood pressure normal as compared to the reference group, when considering hypertension alone for classifying the categories.

Predicted probabilities for combined fruit and vegetable, and salt intake

The predicted probabilities for combined fruit and vegetable intake and salt intake among people with different characteristics across the four strata classified according to the status of diabetes or hypertensionare described in Tables 4-6. For fruit and vegetable intake, being male or female was not making a difference in the probabilities. Still, the age group made a wide variation in the consumption of fruit and vegetables when combining with other characteristics such as education and BMI.

For a 50-69-year-old male under treatment for diabetes or hypertension and keeping normal values of SBP, DBP and FBS, with high school education and healthy BMI, the likelihood for recommended salt intake is very high (0.69). Still, the likelihood of fruit and vegetable intake is very low (0.21) among them. On the contrary, an 18-35-year-old female, under treatment for diabetes or hypertension and keeping abnormal values of SBP, DBP or FBS, who had primary education and obese had a very low probability of following the recommended fruit and vegetable (0.12) and salt (0.07) consumption. Also, the four strata did not make a considerable variation in the probabilities across each row.

Table 2: Combined Fruit and vegetable and salt intake by Status of diabetes and hypertension

Treatment status	Control level	Fruit and vegetable intake >=5 servings per day				Salt intake <5 gm per day			
		N	n	Weighted percentage and 95% confidence Interval		N	n	Weighted percentage and 95% confidence Interval	
Diabetes									
Not Under treatment for Diabetes	FBS normal (<126 mg/dl)	8604	1260	13.7	11.9-15.6	9263	2605	29	27.4-30.6
	FBS above normal (>=126 mg/dl)	1188	137	14.2	11.1-18.1	1265	364	28.9	25.4-32.6
Under treatment for diabetes	FBS normal (<126 mg/dl)	317	58	18.5	12.6-26.3	350	120	38.1	30.7-46.0
	FBS above normal (>=126 mg/dl)	638	94	15.4	11.3-20.6	721	219	32	27.4-36.8
Hypertension									
Not Under treatment for Hypertension	SBP and DBP normal (SBP <140 & DBP <90)	7656	1083	13.8	11.9-15.9	7970	2141	27.3	25.7-28.9
	SBP or DBP above normal	2145	298	13.3	11.1-15.9	2312	737	34.9	32.1-37.9
Under treatment for Hypertension	SBP and DBP normal (SBP <140 & DBP <90)	426	78	18.9	13.4-26.0	468	156	36.9	31.2-42.9
	SBP or DBP above normal	785	108	14.3	10.9-18.6	849	274	31.3	27.3-35.6
Diabetes or Hypertension									
Not under treatment for Diabetes and Hypertension	FBS, SBP and DBP normal (FBS <126 mg/dl, SBP <140, and DBP <90)	6401	940	13.8	11.9-15.9	6853	1836	27.1	25.4-28.9
	FBS or SBP or DBP above normal	2593	335	12.9	10.8-15.3	2808	851	32.3	29.7-35.0
Under treatment for Diabetes or Hypertension	FBS, SBP and DBP normal (FBS <126 mg/dl, SBP <140, and DBP <90)	417	79	20.1	14.4-27.4	451	145	34.9	28.7-41.6
	FBS or SBP or DBP above normal	1336	195	15	12.0-18.7	1487	476	33.3	30.1-36.8

Table 3: Adjusted odds ratios and 95% confidence intervals for fruit, vegetable and salt intake

Treatment status	Control level	Fruit and vegetable intake >=5 servings per day		Salt intake <5 gm per day	
		AOR*	95% CI	AOR*	95% CI
Diabetes					
Not Under treatment for Diabetes	FBS normal (<126 mg/dl)	1		1	
	FBS above normal (>=126 mg/dl)	0.92	0.70-1.21	0.91	0.74-1.12
Under treatment for diabetes	FBS normal (<126 mg/dl)	1.15	0.73-1.81	1.17	0.79-1.73
	FBS above normal (>=126 mg/dl)	0.91	0.65-1.27	1	0.76-1.30
Hypertension					
Not Under treatment for Hypertension	SBP and DBP normal (SBP <140 & DBP <90)	1		1	
	SBP or DBP above normal	0.86	0.70-1.05	1.1	0.94-1.28
Under treatment for Hypertension	SBP and DBP normal (SBP <140 & DBP <90)	1.1	0.72-1.68	1.6	1.18-2.17
	SBP or DBP above normal	0.77	0.56-1.06	1.09	0.86-1.37
Diabetes or Hypertension					
Not under treatment for Diabetes and Hypertension	FBS, SBP and DBP normal (FBS <126 mg/dl, SBP <140, and DBP <90)	1		1	
	FBS or SBP or DBP above normal	0.8	0.65-0.98	1.01	0.86-1.18
Under treatment for Diabetes or Hypertension	FBS, SBP and DBP normal (FBS <126 mg/dl, SBP <140, and DBP <90)	1.16	0.77-1.78	1.27	0.87-1.83
	FBS or SBP or DBP above normal	0.79	0.61-1.02	1.16	0.94-1.42

*The variables included in the multiple logistic regression model were sex, age group, education and BMI category

Table 4: Predicted probabilities of recommended intake of combined fruit and vegetables, and salt among 18-35 years old adults

Characteristics of adults	Males				Females			
	Not under treatment for diabetes and hypertension		Under treatment for Diabetes or Hypertension		Not under treatment for diabetes and hypertension		Under treatment for Diabetes or Hypertension	
	FBS, SBP and DBP normal	FBS or SBP or DBP above normal	FBS, SBP and DBP normal	FBS or SBP or DBP above normal	FBS, SBP and DBP normal	FBS or SBP or DBP above normal	FBS, SBP and DBP normal	FBS or SBP or DBP above normal
Fruit and vegetable intake								
Up to primary education and normal BMI	0.10	0.08	0.12	0.08	0.11	0.09	0.12	0.08
Up to primary education and overweight	0.11	0.10	0.13	0.09	0.12	0.10	0.14	0.10
Up to primary education and obese	0.14	0.11	0.16	0.11	0.14	0.12	0.16	0.12
Secondary to high school education and normal BMI	0.12	0.10	0.13	0.10	0.12	0.10	0.14	0.10
Secondary to high school education and overweight	0.13	0.11	0.15	0.11	0.14	0.12	0.16	0.12
Secondary to high school education and obese	0.16	0.13	0.18	0.13	0.16	0.14	0.19	0.13
Above high school education and normal BMI	0.12	0.10	0.14	0.10	0.13	0.10	0.15	0.10
Above high school education and overweight	0.14	0.12	0.16	0.12	0.15	0.12	0.17	0.12
Above high school education and obese	0.16	0.14	0.19	0.13	0.17	0.14	0.19	0.14
Salt intake								
Up to primary education and normal BMI	0.45	0.45	0.51	0.48	0.16	0.16	0.20	0.18
Up to primary education and overweight	0.32	0.33	0.38	0.36	0.10	0.10	0.13	0.12
Up to primary education and obese	0.20	0.21	0.25	0.23	0.06	0.06	0.07	0.07
Secondary to high school education and normal BMI	0.44	0.44	0.50	0.48	0.16	0.16	0.19	0.18
Secondary to high school education and overweight	0.32	0.32	0.37	0.35	0.10	0.10	0.12	0.11
Secondary to high school education and obese	0.20	0.20	0.24	0.23	0.06	0.06	0.07	0.06
Above high school education and normal BMI	0.47	0.47	0.53	0.51	0.17	0.17	0.21	0.20
Above high school education and overweight	0.34	0.35	0.40	0.38	0.11	0.11	0.14	0.13
Above high school education and obese	0.22	0.22	0.26	0.24	0.06	0.06	0.08	0.07

Discussion

The present study suggests that only a small proportion of adults consumed five or more servings of fruits and vegetables in the general population. The status of diabetes or hypertension and its control did not show a significant role in determining the combined fruit and vegetable and salt consumption of adults, and the practice was observed to be associated with different characteristics such as age, sex and BMI of people. A cross-sectional study conducted in Brazil among adults aged

Table 5: Predicted probabilities of recommended intake of combined fruit and vegetables, and salt among 36-49 years old adults

Characteristics of adults	Males				Females			
	Not under treatment for diabetes and hypertension		Under treatment for Diabetes or Hypertension		Not under treatment for diabetes and hypertension		Under treatment for Diabetes or Hypertension	
	FBS, SBP and DBP normal	FBS or SBP or DBP above normal	FBS, SBP and DBP normal	FBS or SBP or DBP above normal	FBS, SBP and DBP normal	FBS or SBP or DBP above normal	FBS, SBP and DBP normal	FBS or SBP or DBP above normal
Fruit and vegetable intake								
Up to primary education and normal BMI	0.10	0.08	0.12	0.08	0.10	0.09	0.12	0.08
Up to primary education and overweight	0.11	0.10	0.13	0.09	0.12	0.10	0.14	0.10
Up to primary education and obese	0.14	0.11	0.15	0.11	0.14	0.12	0.16	0.12
Secondary to high school education and normal BMI	0.12	0.10	0.13	0.10	0.12	0.10	0.14	0.10
Secondary to high school education and overweight	0.13	0.11	0.15	0.11	0.14	0.12	0.16	0.11
Secondary to high school education and obese	0.16	0.13	0.18	0.13	0.16	0.13	0.19	0.13
Above high school education and normal BMI	0.12	0.10	0.14	0.10	0.13	0.10	0.15	0.10
Above high school education and overweight	0.14	0.12	0.16	0.12	0.15	0.12	0.17	0.12
Above high school education and obese	0.16	0.14	0.18	0.13	0.17	0.14	0.19	0.14
Salt intake								
Up to primary education and normal BMI	0.51	0.51	0.56	0.54	0.20	0.20	0.24	0.22
Up to primary education and overweight	0.38	0.38	0.43	0.41	0.13	0.13	0.15	0.14
Up to primary education and obese	0.24	0.25	0.29	0.27	0.07	0.07	0.09	0.08
Secondary to high school education and normal BMI	0.50	0.50	0.56	0.54	0.19	0.19	0.23	0.22
Secondary to high school education and overweight	0.37	0.37	0.43	0.41	0.12	0.12	0.15	0.14
Secondary to high school education and obese	0.24	0.24	0.29	0.27	0.07	0.07	0.09	0.08
Above high school education and normal BMI	0.53	0.53	0.59	0.56	0.21	0.21	0.25	0.24
Above high school education and overweight	0.40	0.40	0.46	0.43	0.14	0.14	0.17	0.15
Above high school education and obese	0.26	0.26	0.31	0.29	0.08	0.08	0.10	0.09

20-59 years observed a similar finding that the frequency of dietary practices was low in general, and did not differ between the two groups of individuals with and without diabetes and or hypertension.[11] In their study, they found that healthier dietary practices were more frequent in women than in men, and education level of participants was associated with dietary practices. Nevertheless, in the present study, there was no difference between males and females in fruit and vegetable consumption, but the salt intake was higher among females than males. Also, in our study, education did not play a significant role in dietary practices.

It is vital to address the issue of why people with diabetes or hypertension do not mostly change their fruit and vegetable intake. One primary reason may be the low intake of recommended fruit and vegetable in the general population. In low and middle-income countries, above 75% of people consume less than the recommended daily servings of fruit and vegetables.[20] The focus group discussions and individual interviews conducted by Daivadanam *et al.*,[21] to assess strategies to support household level dietary-behavioural changes, observed that there were three fundamental factors greatly influencing the decision to change or maintain a dietary behaviour in the general population. The first one is called decisional balance, which means that if something gets cheap and with less effort than purchasing fruits or vegetables, people may decide to buy the cheaper one. The second one is called risk perception, where those who perceive the chronic disease of a member in the family will seriously take effort to make dietary modifications, and the third one is the attitude towards particular behaviour or foodstuffs. The same authors evaluated an intervention on dietary behaviour change targeting the five components such as fruits, vegetables, salt, sugar and oil. At the end of one year, there was a significant increase in fruit and vegetable procurement, and considerable reduction of monthly household consumption of salt, sugar and oil, and minimal improvement in fruit and vegetable consumption in the intervention arm compared to control arm.[22]

People's knowledge of fruits and vegetable consumption, availability and acceptability are crucial matters of concern. People should get advice on different kinds of fruits and vegetables that are to be eaten by diabetes and hypertensive patients, and the use of local fruits and vegetables are to be encouraged. In Kerala, especially in rural regions, people usually not purchase fruits from shops regularly but use the fruits locally available at home (e.g., banana), and seasonal fruits like jackfruit and mangoes when possible. The seasonal changes and local availability will also affect the consumption of vegetables. These kinds of intake might not be captured adequately in the WHO questionnaire, which again could be a reason for the low intake of fruits and vegetables we observed in our study. The

Table 6: Predicted probabilities of recommended intake of combined fruit and vegetables, and salt among 50-69 years old adults

Characteristics of adults	Males				Females			
	Not under treatment for diabetes and hypertension		Under treatment for Diabetes or Hypertension		Not under treatment for diabetes and hypertension		Under treatment for Diabetes or Hypertension	
	FBS, SBP and DBP normal	FBS or SBP or DBP above normal	FBS, SBP and DBP normal	FBS or SBP or DBP above normal	FBS, SBP and DBP normal	FBS or SBP or DBP above normal	FBS, SBP and DBP normal	FBS or SBP or DBP above normal
Fruit and vegetable intake								
Up to primary education and normal BMI	0.16	0.13	0.18	0.13	0.16	0.13	0.19	0.13
Up to primary education and overweight	0.18	0.15	0.20	0.15	0.19	0.15	0.21	0.15
Up to primary education and obese	0.21	0.17	0.23	0.17	0.21	0.18	0.24	0.18
Secondary to high school education and normal BMI	0.18	0.15	0.20	0.15	0.19	0.16	0.21	0.15
Secondary to high school education and overweight	0.21	0.17	0.23	0.17	0.21	0.18	0.24	0.18
Secondary to high school education and obese	0.24	0.20	0.26	0.20	0.24	0.21	0.27	0.20
Above high school education and normal BMI	0.19	0.16	0.21	0.16	0.19	0.16	0.22	0.16
Above high school education and overweight	0.21	0.18	0.24	0.18	0.22	0.19	0.25	0.18
Above high school education and obese	0.25	0.21	0.27	0.20	0.25	0.21	0.28	0.21
Salt intake								
Up to primary education and normal BMI	0.62	0.62	0.68	0.66	0.28	0.28	0.33	0.31
Up to primary education and overweight	0.49	0.50	0.55	0.53	0.19	0.19	0.23	0.21
Up to primary education and obese	0.34	0.34	0.40	0.38	0.11	0.11	0.14	0.13
Secondary to high school education and normal BMI	0.62	0.62	0.67	0.65	0.28	0.28	0.33	0.31
Secondary to high school education and overweight	0.49	0.49	0.55	0.53	0.18	0.19	0.22	0.21
Secondary to high school education and obese	0.34	0.34	0.39	0.37	0.11	0.11	0.13	0.12
Above high school education and normal BMI	0.64	0.64	0.69	0.68	0.30	0.30	0.35	0.33
Above high school education and overweight	0.52	0.52	0.57	0.55	0.20	0.20	0.24	0.23
Above high school education and obese	0.36	0.36	0.41	0.40	0.12	0.12	0.15	0.14

observation from the NNMS report that almost 98%[2] of people did not follow recommended fruits and vegetable consumption may also be associated with this fact.

The NNMS report also showed a difference of one gram in the average salt intake between males and females (7.1 VS 8 g/day).[2] The high sodium intake of females in the present study invites urgent attention of public health authorities because of its increased risk for several non-communicable diseases such as hypertension, cardiovascular diseases and renal dysfunction among females. A Korean study reported a similar observation and they suggested that the high sodium excretion among women was due to the differences in dietary sources such as manufactured or homely food, whether eating outside or at home, and the total energy intake.[23] These explanations may not be relevant for the present study population. The Korean study also observed that the estimated 24-hour urinary sodium excretion was increasing with increasing age. The authors suggested that older people may consume an increased amount of sodium to get a salty taste due to the loss of taste and smell as age increased.[23] But in the present study, we observed the reverse, maybe because the family members are more conscious about the health status of the elderly, especially for older males.

Strength and Limitations

The analysis of this study is based on a state representative data with a shorter duration and a uniform procedure for data collection. To the best of our knowledge, a stratified analysis to establish the diet pattern concerning the control status of diabetes and hypertension in Kerala is first of its kind. One limitation with this analysis is that the number of participants in the four strata of the study variables was highly varied; with a small number of participants in some strata.

Conclusion

The study found that the condition of diabetes or hypertension did not make considerable changes in the pattern of fruit, vegetable and salt consumption of adults in the study population. That may probably be one of the reasons for the small proportion of people with a satisfactory level of SBP, DBP and FBS among adults with diabetes or hypertension. Observations of the present study can contribute to enhance the skills of physicians for advising and motivating the patients with diverse characteristics such as age, sex and BMI. The probability charts will help them to assess the chance of lower than recommended level of fruit, vegetables and salt intake, and appropriate evaluation and motivation can be considered for improvement. A better strategy for diet control may help more people to keep a controlled level of blood pressure and glucose. The availability and acceptability of such recommended diets need to be explored further in the Kerala context. Specific interventions focussing dietary-behavioural changes among diabetes and hypertensive

patients with different characteristics, especially for different age groups and sex are to be examined and implemented.

Key points from the paper

1) Only a small proportion of adults follow the recommended level of fruit and vegetable consumption.
2) Whether having diabetes or hypertension do not make a considerable change in the fruit and vegetable, and salt intake of adults
3) Individual characteristics, people's knowledge of fruits and vegetable consumption, local availability and acceptability are crucial matters deciding the recommended intake of fruit vegetables and salt.
4) People need different levels of motivation, and education concerning their characteristics is a relevant consideration at primary care physician's practice.

Key message

Having diabetes or hypertension does not make a considerable change in adults' diet pattern. The practice to follow the recommended level of fruit and vegetable and salt consumption among those with diabetes or hypertension is associated with people's characteristics.

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Conflicts of interest

There are no conflicts of interest.

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