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Acta Medica Marisiensis 2016;62(1):82-85 DOI: 10.1515/amma-2015-0095

RESEARCH ARTICLE

The Prevalence and Correlates of Eating Between Meals in a Cross-Sectional Study of a Health Oriented Adult Population

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Objectives: To assess the prevalence of snacking and to explore the relationship between snacking and several demographic, anthropometric, functional and biochemical factors. **Methods**: The study included 756 individuals over 18 years of age from Medias, Romania. Demographics and data about snacking were collected by trained volunteers. Height, weight, waist circumference, blood pressure were measured with standard equipment according to accepted procedures. Blood glucose and cholesterol were measured by experienced nurses using portable devices. Associations between variables were checked with the Pearson Chi-square test. Odds ratios and 95% confidence intervals were calculated to measure the association between binary variables. **Results**: About half of the subjects in the studied sample reported snacking less than 2 times / week, 34.5% between 3-4 times / week and 14.8% more than 4 times / week. Statistical analysis found that snacking was associated with gender (males being less likely to snack than females), ethnicity (non-Romanians being less likely to snack than Romanian ethnics), marital status of the subjects (not married people being less likely to snack than married people), systolic blood pressure (people consuming more often snacks being less likely to have high systolic blood pressure values), and blood sugar level (people eating more frequently between meals being more likely to have higher blood glucose levels). **Conclusions**: Snacking was a widespread eating habit among the study participants and was significantly associated with gender, ethnicity, marital status, systolic blood pressure and blood glucose levels.

Keywords: eating between meals, nutrition, correlates, blood pressure, blood glucose

Received: 27 August 2015 / Accepted: 02 November 2015

Introduction

Avoiding or limiting food consumption between regular meals has been considered for almost half a century a behavioral factor that may contribute to enhanced health and increased longevity [1]. Snacking or between meal eating episodes (BMEE) seem correlated with a high caloric intake [2]. In US adult population, snacks provide 24% of the total daily calory intake and 1 out of 6 American adults are taking over 40% of their daily calories from food and beverages reported as snacks [3]. There are studies suggesting that a high consumption of sweets, snacks, spices, carbohydrates and a low vegetable intake could promote weight gain and might increase the risk of diabetes [4,5]. However, there is no generally accepted definition of snacks and there is no consensus about the impact of snacking on diet quality [6,7].

A limited number of studies have explored the demographic and social correlates of snacking in different populations around the world [3,8-10]. Exposure to commercial advertising of snacks and the extent of watching TV programs was associated with a higher likelihood of serving fast foods and sweets, in both children and adults [11,12].

Given the lack of information in this area, this study aimed: (1) to assess the prevalence of snacking as a component of eating behavior in a group of people with an increased degree of interest in health issues and (2) to explore the relationship between snacking and several demographic, anthropometric, functional and biochemical factors.

Material and methods

Subjects

The sampling frame consisted of 871 persons who participated voluntarily in a community health promotion campaign called Health-Expo, between 1-4 June 2010 in Medias, a city with an estimated population of about 50,000 inhabitants. The organizational details of the campaign were described in detail in a previously published paper [13]. The analytical sample for the study included 756 individuals over 18 years of age, who agreed to answer the questionnaire and requested the measurements offered by the organizers at the campaign location. The participation rate was 86.8%.

Collected / measured variables

Demographics (age, gender, residence, educational attainment, marital status, ethnicity) and data about snacking were collected by trained volunteers. Height, weight, waist circumference, blood pressure were measured with standard equipment according to accepted procedures. Body mass index (BMI) was calculated according to the formula: BMI = weight (kg) / height^2 (m). Blood glucose and cholesterol were measured using portable devices (Bioland G-423™, respectively Accutrend PLUS™). In both cases,

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capillary sampling was performed by experienced nurses following strict asepsis rules and the equipment manufacturer's technical instructions.

Subjects were grouped into subcategories based on reference values accepted in the literature, as follows: BMI (<18.5 units - underweight, between 18.5 and 24.9 units - normal weight, between 25.0 and 29.9 units - overweight; ≥ 30 units - obese) [14], abdominal circumference (102 cm in men or 88 cm in women) [15], blood pressure (<140 mmHg / ≥ 140 mmHg) [16], blood glucose levels (<126 mg / dL / ≥ 126 mg / dL) [17], the total cholesterol (<240 mg / dL / ≥ 240 mg / dL) [18].

Statistical analysis

Descriptive statistics were calculated by categories and subcategories for each collected variable. Associations between variables were checked with the Pearson Chi square test. Odds ratios and 95% confidence intervals were calculated to measure the association between binary variables. Statistical analyzes were performed in SPSS Base. V.22 package. The threshold value of statistical significance was set at 0.05.

Results

The descriptive data of the current sample are presented in Table I.

The distribution of subjects according to the frequency of snacking is shown in Figure 1.

The relationship between the frequency of snacking (dichotomised: no = seldom or never / yes = 3-7 days / week) and demographic variables is presented in Table II.

The relationship between the frequency of snacks between meals (dichotomised: no = seldom or never / yes = 3-7 days / week) and anthropometrical, functional, biochemical characteristics are shown in Table III.

Table I. Demographic characteristics of the sample

Variable	Categories	N (%)
Age	18-29 years	21 (2.8)
	30-39 years	57 (7.5)
	40-49 years	87 (11.5)
	50-59 years	157 (20.8)
	60-69 years	243 (32.1)
	≥ 70 years	191 (25.3)
Gender	Male	524 (69.3)
	Female	232 (30.7)
Residence	Urban	688 (91.0)
	Rural	68 (9.0)
Educational attainment	Primary school	96 (12.7)
	Secondary school	192 (25.4)
	High school	265 (35.1)
	College	109 (14.4)
	University	94 (12.4)
Marital status	Single	81 (10.7)
	Married	473 (62.6)
	Divorced	46 (6.1)
	Widowed	156 (20.6)
Ethnicity	Romanian	645 (85.3)
	Hungarian	95 (12.6)
	Other	16 (2.1)

Discussions

The research has found that snacking was a widespread eating habit among the study participants but not as common as reported in some other countries. Almost half of the subjects in our study (49.3%) were serving snacks on a daily basis or at least 3-4 times a week. A US study showed that between 60-70% of American children and 40-65% of American adults serve snacks at least once a day [19]. A Brazilian study reported that 74% of the individuals over 10 years of age used to serve a snack per day, and another 23% three or more than three snacks per day [20]. However, comparison of data has to be done with caution keeping in mind the lack of generally accepted definitions and methods for snacks quantification as well as differences in sampling.

Snacking was associated with gender (males being less likely to snack than males OR=0.512), ethnicity (other ethnics being less likely to snack than Romanian ethnics OR=0.577) and marital status of the subjects (not married people being less likely to snack than married people OR=0.690), but not with age, residence and educational attainment. While marketing research data published in popular media shows that American women are 15% more likely to snack than men, we found no scientific papers that support or reject the association of gender, ethnicity and marital status observed in our study.

More frequent snacking was associated in our study with lower systolic blood pressure. This finding is somewhat intriguing if salty snacks are taken in consideration although the link between high salt intake and hypertension is still a matter of scientific debate [21]. A plausible explanation of the inverse association found in our study could be related to the beneficial effect of healthy snacks, such as fruits, known for their high potassium content [22].

The association of frequent eating between meals and higher blood glucose values in our sample is another finding that needs further clarification since some studies suggest a beneficial effect of more frequent eating on blood sugar levels [23]. However, these studies measured glycemia in diabetic subjects trying to control their blood sugar by dietary pattern manipulation.

Our study showed no association between snacking and BMI or waist circumference. While some of the published studies suggest that regardless of the macronutrient com-

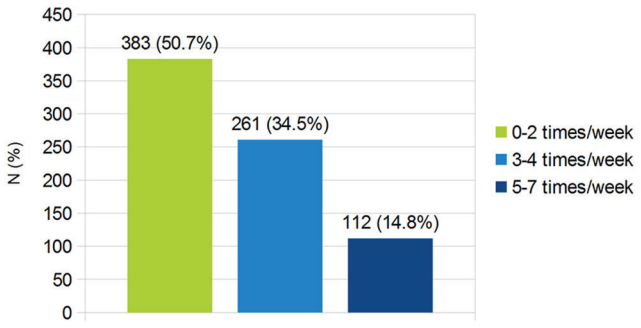

Fig. 1. Prevalence of snacking by frequency

Table II. Analysis of the association between frequency of snacks and demographic variables

Variable		Snacking		χ^2	p value	OR** (95% CI)***
		No	Yes			
		N (%)	N (%)			
Age	18-29 years	8 (38.1)	13 (61.9)	6.729	0.242	-
	30-39 years	31 (54.4)	26 (45.6)			
	40-49 years	41 (47.1)	46 (52.9)			
	50-59 years	70 (44.6)	87 (55.4)			
	60-69 years	126 (51.9)	117 (48.1)			
	≥70 years	107 (56.0)	84 (44.0)			
Gender	Male	144 (62.1)	88 (37.9)	17.426	<0.0001	0.512 (0.374-0.703)
	Female	239 (45.6)	285 (54.4)			
Residence	Urban	348 (50.6)	340 (49.4)	0.020	0.889	0.965 (0.586-1.589)
	Rural	35 (51.5)	33 (48.5)			
Educational attainment*	Under graduate studies	337 (50.9)	325 (49.1)	0.128	0.721	1.082 (0.702-1.667)
	Graduate studies	46 (48.9)	48 (51.1)			
Ethnicity *	Romanian	314 (48.7)	331 (51.3)	6.885	0.009	0.577 (0.382-0.873)
	Other	69 (62.2)	42 (37.8)			
Marital status*	Married	127 (44.9)	156 (55.1)	6.056	0.014	0.690 (0.513-0.928)
	Other	256 (54.1)	217 (45.9)			

* The original subcategories were merged in order to meet the conditions required by the statistical test; ** OR = Odds Ratio; 95% CI = 95% Confidence interval

Table III. Analysis of the association between frequency of snacks and the anthropometrical, functional, and biochemical variables

Variable		Snacking		χ^2	p value	OR** (95% CI)***
		No	Yes			
		N (%)	N (%)			
BMI*	<24,99	76 (46.9)	86 (53.1)	1.159	0.282	0.826 (0.583-1.170)
	≥25	307 (51.7)	287 (48.3)			
Waist circumference	Males <102 cm Females < 88cm	102 (53.1)	90 (46.9)	0.625	0.429	1.141 (0.822-1.584)
	Males ≥102 cm Females ≥ 88cm	281 (49.8)	283 (50.2)			
SBP*	< 140 mmHg	192 (46.7)	219 (53.3)	5.611	0.018	0.707 (0.530-0.942)
	≥ 140 mmHg	191 (55.4)	154 (44.6)			
DBP*	< 90 mmHg	226 (48.4)	241 (51.6)	2.513	0.113	0.788 (0.588-1.058)
	≥ 90 mmHg	157 (54.3)	132 (45.7)			
Blood glucose*	< 126 mg/dL	349 (51.9)	323 (48.1)	3.922	0.048	1.589 (1.002-2.520)
	≥ 126 mg/dL	34 (40.5)	50 (59.5)			
Total cholesterol*	<200 mg/dL	124 (55.6)	99 (44.4)	3.011	0.083	1.320 (0.964-1.808)
	≥ 200 mg/dL	259 (48.7)	273 (51.3)			

BMI: body mass index; SBP: systolic blood pressure; DBP: diastolic blood pressure; * The original subcategories were merged in order to meet the conditions required by the statistical test; ** OR = Odds Ratio; 95% CI = 95% Confidence interval

position of the snacks, eating between meals can lead to overeating and thus obesity [24,25], other data suggest no relationship or negative relationship between snacking and overweight [26].

A first limitation of this study is the non-random selection of the subjects which limits the external validity of the observations. Compared to the general population, the study sample had a relatively high proportion of women (the woman to man ratio was over 2 to 1) and elderly (almost 50% of the subjects were over 50 years old). These particularities of the participants to Health-Expo campaigns were observed at other similar events organized in several cities of Romania [13,27]. These disproportionalities are very likely a result of self-selection and might be attributed to a heightened interest of women and the elderly toward their health status [28-30]. Supposedly, other factors specific to the elderly, such as the availability of free time and a stronger need for socialization might explain their overrepresentation in the studied sample.

The second limitation has to do with the accuracy of the responses. Hearing impairment and modest literacy level of some of the senior subjects might have impeded the precision of the answers given to the operators. Furthermore, in as much as snacking was perceived by respondents as a bad and shameful dietary habit, a systematic distortion of the answers – due to the phenomenon of social desirability bias - can not be excluded [31]. Finally, the discriminative power of the study was probably limited by the fact that the survey questions addressed only the frequency of snack consumption without specifying the types of food that qualify as snacks.

In spite of these limitations, the results of this study expand our knowledge about the habit of snacking and eating behavior in general. The data about snacking prevalence and correlates of snacking revealed in the study can help the organizers of community health promotion activities to tailor nutrition education messages more closely to the needs of the target population.

Replicating the investigation on a representative sample and the inclusion of more questions about the types of foods consumed as snacks could improve the accuracy and the value of the study.

Conclusions

While half of the subjects in the studied sample reported that they never or almost never use snacks, one-third of the subjects reported snacking 3-4 times a week and 15% daily or almost daily.

Snacking was significantly associated in our sample with the gender, ethnicity and marital status of the subjects and also with their systolic blood pressure and blood glucose levels.

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