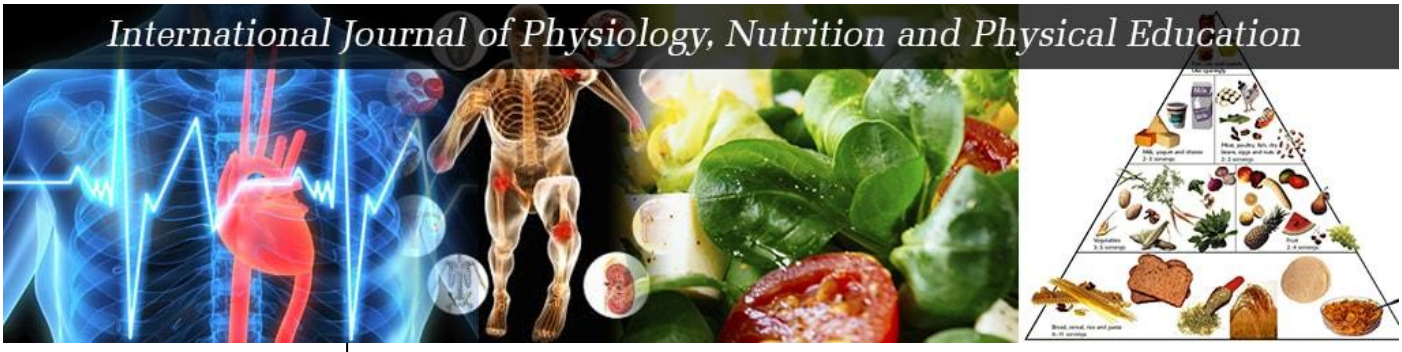

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Nutritional quality analysis of green salad served at selected restaurants

Dr. Prabhjot Kaur and Dr. Vinti Davar

Abstract
Introduction: Food quality seems to be accepted as a fundamental component to satisfy restaurant customers; however, it has been often overlooked in restaurant service quality and satisfaction studies. Eating out at restaurants often means eating foods that are fat and calorie bombs due to the large portion sizes and unhealthy cooking methods. Restaurant foods contain lots of calories, sugar, sodium and unhealthy fats hence they increase the risk of obesity, type 2 diabetes, high blood pressure and heart disease. Increased health risks are directly associated with increased consumption of restaurant foods. This food however generally lacks in certain essential nutrients like proteins, vitamins and minerals thus causing greater imbalance.
Objectives: The study was carried out with the following objectives:

- To calculate the proximate composition of green salad served at selected restaurants
- To evaluate the nutritional adequacy of green salad served thereto

Methodology: The green salad samples were procured from private, public and fast food restaurants in a sterile ice box. Development of the standardized recipe and proximate composition analysis were performed to evaluate energy, carbohydrate, protein, fats, fibre, ash and moisture content. The proximate values were calculated in triplicate. The mean scores of the triplicates and standard deviation were calculated using SPSS 16.0 version.
Results and Conclusion: The results indicated that green salad served at all three types of restaurants was found to be higher in fat content ranging from 200 to 800 per cent with reference to the standardized recipe. It was noted that green salad of private restaurants (R1) was having slightly higher amount of energy (8 per cent) and fibre content (13 per cent) but whereas that served in public restaurants (R2) ranked lower in energy (-10 per cent), carbohydrate (-5 per cent), protein (-90 per cent) and fibre (6 per cent) content as compared to the standardized recipe. Fast food restaurants (R3) however served green salad with lower carbohydrate (-10 per cent) and protein (-96 per cent) content.

Keywords: Food quality, proximate composition, nutritional adequacy, restaurants

Introduction
Food quality seems to be accepted as a fundamental component to satisfy restaurant customers; however, it has been often overlooked in restaurant service quality and satisfaction studies. Eating out at restaurants often means eating foods that are fat and calorie bombs due to the large portion sizes and unhealthy cooking methods. Restaurant foods contain lots of calories, sugar, sodium and unhealthy fats hence they increase the risk of obesity, type 2 diabetes, high blood pressure and heart disease. Increased health risks are directly associated with increased consumption of restaurant foods. This food however generally lacks in certain essential nutrients like proteins, vitamins and minerals thus causing greater imbalance. Also routine customers are not very much aware of the nutritive value parameters which can help them make healthier choices. In addition to this, no nutritional information about the food being served is provided by the restaurants on their menu cards.
Keeping all these factors in mind, the present research entitled "Nutritional Quality Analysis of Green Salad served at Selected Restaurants" has studied the primary aspects of overall quality of the food served at private, public and fast food restaurants.

Review of Literature

Food is the tangible or touchable component of the dining experience (Payne-Palacio and Theis, 2005) [10]. The word quality is considered to be the most commonly-used word in the area of food industry-production and service (Mcllveen, 1994 and Meiselman, 2001) [7]. Generally, most historical records emphasized the importance of food quality control as a basic requisite to protect consumers (Whitehead, 1995) [14].

Morris and Young (2000 cited Straete, 2008) [11] reported that the aspects of food quality cover the following elements: method of production, place of production, traceability, raw materials/content, safety, nutrition, sensual attributes, functional, and biological. (Cardello, 1995 cited Klosse *et al*., 2004) [2] Stated that "food quality can be considered both the most well-defined and the least well-defined concept in the food industry today". Generally researchers described food quality as involving six attributes: (1) presentation (2) variety (3) healthy options (4) taste (5) freshness, and (6) temperature (Namkung and Jang, 2007; 2008) [9].

Cousins *et al*.(2002) proposed two distinctive aspects which food service operations involve: (1) technical standards (product quality, e.g. food items, portion size, cooking method, presentation) and (2) service standards (service quality including service procedures, e.g. meeting and greeting, order-taking, payment, and how these procedures are implemented, e.g. body language and tone of voice). They further shed light on the importance of balance between those two aspects.

Recent literature indicates that American society tends to offer foods that are higher in calories and fat at a cheaper cost and greater availability than fresh produce and other foods which are high in nutritional quality (Finkelstein, Ruhm, and Kosa, 2005) [4]. Residents living in areas with high concentrations of fast food restaurants are more likely to consume more calories, fat, saturated fat, and cholesterol (Lewis *et al*., 2005) [6].

Approximately one-third of main dishes at fast-food restaurant chains and half of main dishes at sit down restaurant chains exceeded the 2010 Dietary Guidelines for Americans recommended levels for sodium, fat, and saturated fat in 2014. Improvements in nutrient content were observed for side dishes. At sit down restaurant chains, added side dishes contained over 50 per cent more calories, fat, saturated fat, and sodium, and were less likely to contain fruits/vegetables. Consumption of diet high in sugar, saturated fat, salt and calorie content in children can lead to early development of obesity, hypertension, dyslipidemia and impaired glucose tolerance. Fast foods have high level of fat and sugars that are not only unhealthy but addictive and that creates a vicious cycle making it hard for children to choose healthy food. High content of trans-fat in commercially available fast foods predispose children to risk of future heart diseases (Asgary S. *et al*., 2009) [1].

Junk foods often contain colors that are inedible, carcinogenic and harmful to the body. Food coloring may result in hyperactivity and lapses of concentration in children. Poor nutritional habits can undermine these pre-requisites of learning, as well as decrease the strength that children need for making friends, interacting with family, participating in sports and games or simply feeling good about them. Rising trends in obesity have been attributed largely to increased caloric intake and have coincided with an exponential increase in the amount of money households in developed nations spend on food away from home, currently representing over one third of calories purchased in US. Food prepared away from home is typically higher in calories and lower in nutrient density than foods prepared at home. Recent work characterizing the nutritional quality of foods sold at quick-service restaurants has documented high energy, fat, and sodium in those foods. Available data suggests that full-service restaurants serve oversized portions and foods of low nutritional quality.

Nutritional labeling refers to disclosure of nutritional content (calories, added sugar, total fat, trans-fat, saturated fat, sodium and protein content) in product labels. Nutritional value should be provided in menu, menu boards, food wrappers and containers in fast food restaurant. This might restrict the quantity and choice of food among children of educated parents. In a recent study conducted on parents of children aged 3-6 years, it was observed that parents who were offered the nutritional value menu card ordered food of lesser calorie (Tandon P.S. *et al*., 2010) [12]. However in a study by Yamamota *et al*. (2005) [13], it was observed that provision of nutritional value did not modify the food ordering behavior among the enrolled adolescents. It has been often debated that labeling might result in financial loss to fast food industry, but it has been shown that restaurants which project lower fat menu have a better customer satisfaction (Fitzpatrick M.P. et. al., 1997) [5].

Methodology

Permission was sought from the restaurants and only 32 restaurants showed willingness to participate. Out of these, only 6 restaurants i.e. two private restaurants (R1), two public restaurants (R2) and two fast food restaurants (R3) were selected for nutritional quality analysis owing to the feasibility of sample collection. The green salad samples were procured from private, public and fast food restaurants in a sterile ice box. The same were then dried in hot air oven to remove moisture and ground to fine powder. This powder was then used for proximate composition analysis to calculate the major nutrients energy, carbohydrate, protein, fats along with fibre. The standardized recipe was also formulated in consultation with the chefs of different restaurants and prepared by the researcher in hygienic settings (Annexure 1). Proximate composition analysis was also performed to evaluate energy, carbohydrate, protein, fats, fibre, ash and moisture content in the laboratory. The proximate values were calculated in triplicate and thereafter the mean values of two restaurants of each type were calculated for usage in further discussions. The mean scores of the triplicates and standard deviation were calculated using SPSS 16.0 version.

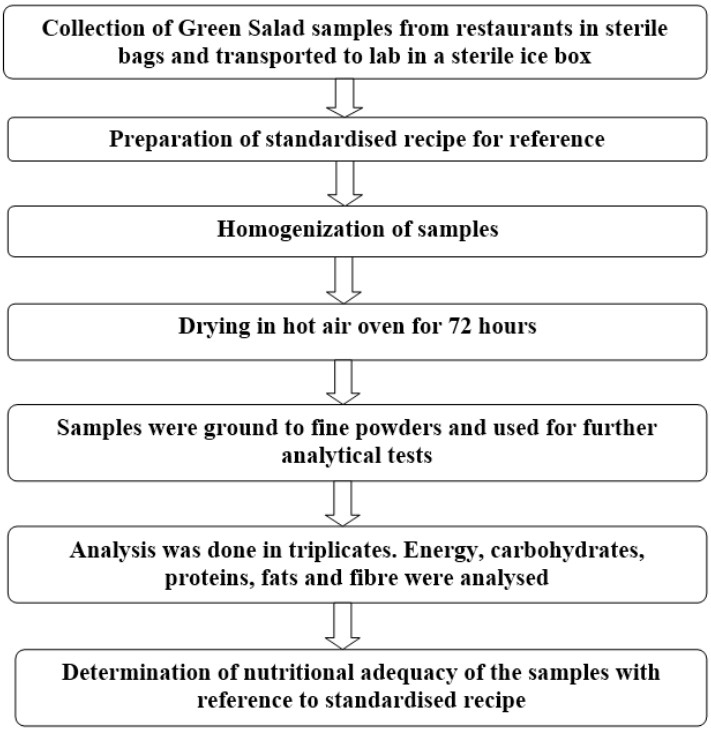

Fig 1: Methodology for Evaluating the Nutritional Adequacy of Green SaladSamples at a Glance

Fig. 1 represents the steps of methodology for evaluating the nutritional adequacy of green salad samples at a glance. The details of the steps are presented and discussed in the subsequent sections.

Results and Discussion

A. Evaluation of Nutritional Quality of Green Salad

The present data involves six studied restaurants i.e. two private restaurants (R1), two public restaurants (R2) and two fast food restaurants (R3). The mean of the values of both the restaurants of one type have been used in further discussions. To test whether the three types of restaurants differ over the major nutrients viz. carbohydrate, protein, fats along with fibre in green salad being served at these establishments and the standardised recipe, one-way analysis of variance (ANOVA) was employed. The results of ANOVA for these four nutrients appear in Table 2. An evident variation was observed at all four nutrients amongst these establishments and also significant difference was found in standardized recipe with each organization studied. It may be noted that the degrees of freedom (D.F.) being 2 and 6, the tabulated F-value is 5.14 and 10.92 at 0.05 and 0.01 probability levels, respectively. In majority of the cases, the calculated F-value for the components was found to be highly significant at both the probability levels. It clearly indicated that all the six organizations varied in nutritive value.

Further, independent samples t-test was carried out on private versus public restaurants, private versus fast food restaurants and public versus fast food restaurants to test the significance of difference between these restaurants. The results of t-test have been presented in Tables 3 to Table 5. It may be noted that the degree of freedom being 4, the tabulated value of t is 2.132 and 3.747 at 0.05 and 0.01 probability levels respectively. The calculated values of t for the comparisons are highly significant at both the probability levels in majority of the cases. This further authenticates that the private, public and fast food restaurants differ significantly from each other in nutritive value of the selected recipes. The results of the evaluation of the nutritional quality are presented as under:

a) Proximate Composition Analysis of Green Salad Samples

Proximate composition analysis for energy, carbohydrate, protein, fats and fibre content was done using Socsplus, Kel plus and Fibraplus series. The values were calculated in triplicate and thereafter the mean values were calculated for usage in further discussions. There is a wide range of listings in the menus of the different types of studied restaurants and there is an increased trend of consumption of snacks especially by the adolescents at fast food restaurants. In order to maintain the uniformity for comparative analysis for all the three types of restaurants, the focus was to select the same recipes from all the studied restaurants. This recipe was selected in consultation with restaurant managers of different restaurants as well as from the respondents as this was most commonly ordered by the guests while dining out in all the three types of restaurants. The standardized recipe was also developed in consultation with the chefs of different restaurants and thereafter prepared by the researcher in laboratory under hygienic settings. The details of the ingredients and method of preparation of the standardized recipe has been discussed in Annexure 1.

b) Evaluation of Nutritional Quality of Green Salad

Table 1 demonstrates the results of the evaluation of the nutritional quality of green salad served in the selected restaurants in the form of mean and standard deviations. The various samples and the standardized recipe were subjected to proximate composition analysis for calculation of energy, carbohydrate, protein, fats and fibre content. The mean values for energy of private, public and fast food restaurants are 30.16 ± 3.34 g, 25.19 ± 0.22 g and 28.96 ± 1.80 g respectively while the same has been observed 28.25 ± 0.00 g for the standardized recipe. However, all the mean values for the amount of carbohydrates present in green salad were found to be lesser than the standardized recipe with a mean value of 5.73 ± 0.00 g. A similar trend has been illustrated in Table 1 for protein content wherein the standardized recipe has a mean value of 1.01 ± 0.00 g. The public restaurants have

exhibited minimum mean value of 0.30 ± 0.00 g for the fat content of green salad while the same has been found to be maximum in fast food restaurants with a mean value of 0.93 ± 0.23 g. This table below clearly indicates that the fat content of green salad has increased as compared to the standardised recipe. This could be perhaps easily correlated with the dressings and glazes used by the restaurants on cut salads in order to give them a fresh look. A little hike is observed in case of fibre as well with the highest mean value of 0.85 ± 0.09 g as against 0.60 ± 0.00 g of the standardized recipe.

Table 1: Comparison of Proximate Values of Green Salad (GS) served in Private, Public and Fast Food Restaurants

GS	Energy (kcal)		Carbohydrate (g)		Protein (g)		Fats (g)		Fibre (g)	
	Mean	S.D.*	Mean	S.D.*	Mean	S.D.*	Mean	S.D.*	Mean	S.D.*
R1	30.16	3.34	5.50	0.10	0.99	0.24	0.47	0.29	0.70	0.05
R2	25.19	0.22	5.36	0.04	0.26	0.02	0.30	0.00	0.60	0.00
R3	28.96	1.80	4.91	0.03	0.23	0.05	0.93	0.23	0.85	0.09
SR**	28.25	0.00	5.73	0.00	1.01	0.00	0.10	0.00	0.60	0.00

*Standard Deviation
** Standardised Recipe

Table 2: Analysis of Variance (ANOVA) among Nutritive Value of Green Salad served in Private, Public and Fast Food Restaurants

		Sum of Squares	df	Mean Square	F	Sig.
Energy	Between Groups	40.296	2	20.148	4.172	.073
	Within Groups	28.973	6	4.829		
	Total	69.269	8			
Carbohydrate	Between Groups	.579	2	.290	70.834	.000**
	Within Groups	.025	6	.004		
	Total	.604	8			
Protein	Between Groups	1.106	2	.553	28.591	.001*
	Within Groups	.116	6	.019		
	Total	1.222	8			
Fats	Between Groups	.647	2	.323	7.098	.026*
	Within Groups	.273	6	.046		
	Total	.920	8			
Fibre	Between Groups	1.232	2	.616	173.231	.000**
	Within Groups	.021	6	.004		
	Total	1.253	8			

*Significant at $p \leq 0.05$
**Significant at $p \leq 0.001$

Energy

Judgement of energy means from Table 1 explored that private restaurants (R1) have the highest mean value of 30.16 ± 3.34 kcal and public restaurants (R2) have the lowest mean value of 25.19 ± 0.22 kcal for energy and the difference among all the three types of restaurants is very small. The calculated F- value of 4.172 (Table 2) is lower than the tabulated value which holds that the energy level of green salad served in private, public and fast food restaurants is almost similar.

In order to further investigate this, t-test was conducted. The calculated values of t were found to be lower than the respective tabulated values (Tables 3 to 5) with p-values of 0.062 and 0.613 at 95 per cent confidence level respectively for private versus public and private versus fast food restaurants thus confirming the insignificant difference among these categories. However, a p-value of 0.023 at 95 per cent confidence level between the public and fast food restaurants signifies the significant relation between them. This sustains ANOVA conclusions.

Table 3: Comparison of Nutritive Value of Green Salad served in Private and Public Restaurants

		T	Df	Sig. (2-Tailed)
Energy	Equal Variances Assumed	2.566	4	.062
	Equal Variances Not Assumed	2.566	2.017	.123
Carbohydrate	Equal Variances Assumed	2.195	4	.093
	Equal Variances Not Assumed	2.195	2.636	.128
Protein	Equal Variances Assumed	5.348	4	.006*
	Equal Variances Not Assumed	5.348	2.022	.032*
Fats	Equal Variances Assumed	1.000	4	.374
	Equal Variances Not Assumed	1.000	2.000	.423
Fibre	Equal Variances Assumed	26.847	4	.000**
	Equal Variances Not Assumed	26.847	2.001	.001*

*Significant at $p \leq 0.05$
** Significant at $p \leq 0.001$

Carbohydrate

The means of the carbohydrate component from Table 1 revealed that private restaurants (R1) have the highest mean value of 5.50 ± 0.10 g and fast food restaurants (R3) have the lowest mean value of 4.91 ± 0.03 g for carbohydrates and none of them has been able to meet the standardised recipe value. The calculated F-value of 70.834 (Table 2) is greater than the tabulated value thereby advocating the significant

difference.

In order to validate the results, t-test was performed. The calculated values of t were just near to the tabulated value in private versus public restaurants thereby proving the insignificant difference between them. However, greater t values than the respective tabulated ones were observed in private versus fast food restaurants and public versus fast food units (Tables 4 and 5) indicating the significant and highly significant difference with p-values of 0.001 and 0.000 at 99 per cent confidence level respectively between these restaurants. These support ANOVA results.

Table 4: Comparison of Nutritive Value of Green Salad served in Private and Fast Food Restaurants

		t	df	Sig. (2-tailed)
Energy	Equal variances assumed	.547	4	.613
	Equal variances not assumed	.547	3.070	.622
Carbohydrate	Equal variances assumed	9.966	4	.001*
	Equal variances not assumed	9.966	2.252	.007*
Protein	Equal variances assumed	5.454	4	.005*
	Equal variances not assumed	5.454	2.153	.027*
Fats	Equal variances assumed	-2.186	4	.094
	Equal variances not assumed	-2.186	3.816	.097
Fibre	Equal variances assumed	-2.516	4	.066
	Equal variances not assumed	-2.516	2.893	.090

*Significant at $p \leq 0.05$

** Significant at $p \leq 0.001$

Protein

An evaluation of the protein means from Table 4.2.1.6 of the studied restaurants showed that private restaurants (R1) have the highest mean value of 0.99 ± 0.24 g and fast food restaurants (R3) have the least mean value of 0.23 ± 0.05 g for protein and there exists only a slight difference among the private, public and fast food restaurants. The calculated F-value of 28.591 (Table 2) is greater than the tabulated value which highlights the significant difference among the three types of eateries.

Results of t-test were scrutinised for this. The calculated values of t were higher than the respective tabulated values in case of private versus public restaurants with a p-value of 0.006 (Table 4) and private versus fast food restaurants with a p-value of 0.005 (Table 5) while lower in case of public versus fast food restaurants with a p-value of 0.402 (Table 6) at 95 per cent confidence level. Therefore the difference stands significant between private versus public restaurants and private versus fast food restaurants while it is insignificant between public versus fast food outlets. These match the ANOVA results as well.

Fats

Fats means from Table 1 highlighted that fast food restaurants (R3) have the highest mean value of 0.93 ± 0.23 g and public restaurants (R2) have the lowest mean value of 0.30 ± 0.00 g for fats and all of them are above in fats than the standardised recipe value. In addition to this, they do not differ substantially from each other. The calculated F-value of 7.098 (Table 2) is not much higher than the tabulated value which marks the slightly significant difference among the selected categories.

To further confirm this, results of t-test were evaluated. The calculated t values were lower than the respective tabulated values which clearly establish that the selected restaurants do not vary significantly from each other in terms of fats content. However, a satisfactory p-value of 0.009 at 95 per cent confidence level was found between public versus fast food restaurants (Tables 3 to 5) thereby marking the slightly significant difference. This is in agreement with ANOVA outcomes as well.

Table 5: Comparison of Nutritive Value of Green Salad served in Public and Fast Food Restaurants

		t	df	Sig. (2-tailed)
Energy	Equal variances assumed	-3.594	4	.023*
	Equal variances not assumed	-3.594	2.060	.066
Carbohydrate	Equal variances assumed	16.614	4	.000**
	Equal variances not assumed	16.614	3.348	.000**
Protein	Equal variances assumed	.936	4	.402
	Equal variances not assumed	.936	2.552	.429
Fats	Equal variances assumed	-4.750	4	.009*
	Equal variances not assumed	-4.750	2.000	.042*
Fibre	Equal variances assumed	-15.826	4	.000**
	Equal variances not assumed	-15.826	2.000	.004*

*Significant at $p \leq 0.05$

** Significant at $p \leq 0.001$

Fibre

While appraising fibre means from Table 1 of the selected units, it was noted that fast food restaurants (R3) have the highest mean value of 0.85 ± 0.09 g and public restaurants (R2) have the lowest mean value of 0.60 ± 0.00 g for fibre and the difference among all the three types of restaurants is clearly visible. All of them are at higher level in terms of fibre than the standardised recipe. The calculated F-value of 173.231 (Table 2) is highly above the tabulated value which signifies the significant difference existing among them.

To further verify the results, t-test was conducted. The calculated values of t were greater in case of private versus public restaurants but lower than the respective tabulated values in case of other two comparisons. However a highly

significant difference is established between private versus public restaurants and public versus fast food outlets owing to the satisfactory p-value of 0.000 at 99 per cent confidence level (Tables 3 and 5). However, no significant difference exists between private and fast food restaurants owing to p-value of 0.066 at the same level of confidence (Table 4). This supports ANOVA results.

B. Checking Nutritional Adequacy of Green Salad

Figure 2 shows percent variation in the nutritive value of green salad served in various types of restaurants in comparison to the standardized recipe values. The bar graph indicates that the green salad served in all the three types of restaurants is found to be higher in fat content ranging from 200 to 800 per cent with reference to the standardized recipe. It was noted that the green salad of private restaurants (R1) is having slightly higher amount of energy (8 per cent) and fibre content (13 per cent) but whereas that served in public restaurants (R2) ranked lower in energy (-10 per cent), carbohydrate (-5 per cent), protein (-90 per cent) and fibre (6 per cent) content as compared to the standardized recipe. Fast food restaurants (R3) however served green salad with lower carbohydrate (-10 per cent) and protein (-96 per cent) content.

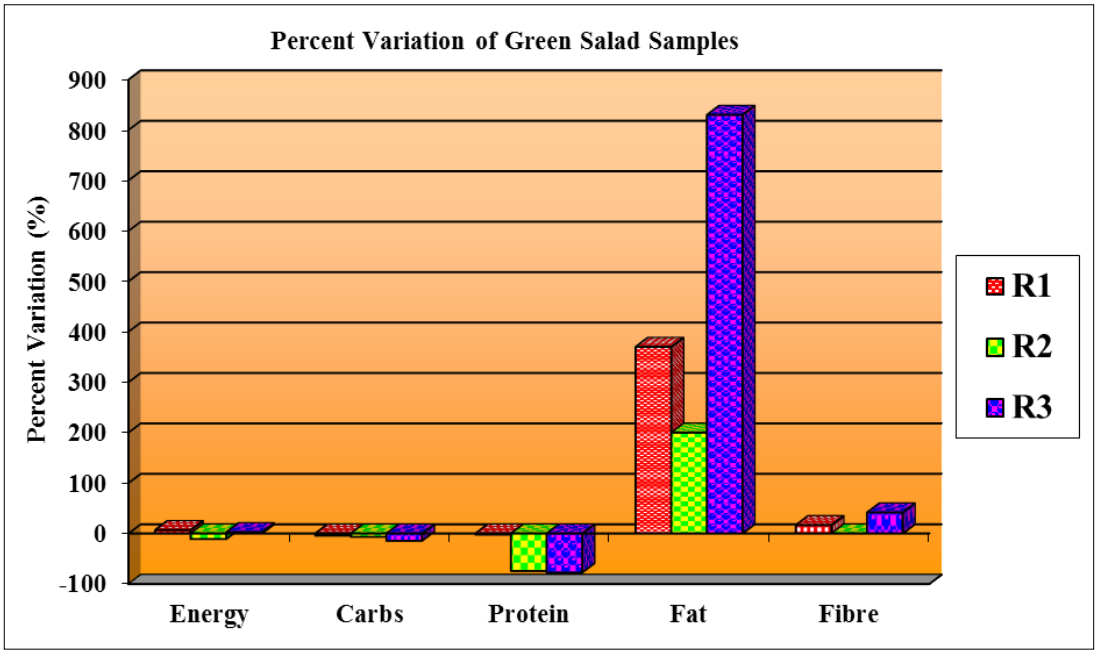

Fig 2: Percent Variation in Nutritional Adequacy of Green Salad served in Private, Public and Fast Food Restaurants

References

1. Asgary S, Nazari B, Sarrafzadegan N, Parkhideh S, Saberi S, Esmaillzadeh A *et al.* Evaluation of fatty acid content of some Iranian fast foods with emphasis on trans- fatty acids. Asia Pac. J Clin. Nutr. 2009; 18:187-92.
2. Cardello AV. Food quality: relativity, context and consumer expectations. Food Quality and Preference. 1995; 6:163-170.
3. Cousins J, Foskett D, Gillespie C. Food and Beverage Management 2nd ed. Harlow: Prentice Hall, Pearson Education, Inc, 2002.
4. Finkelstein EA, Ruhm CJ, Kosa KM. Economic causes and consequences of obesity. Annual Review of Public Health. 2005; 26:239-257.
5. Fitzpatrick MP, Chapman GE, Barr SI. Lower-fat menu items in restaurants satisfy customers. J Am Diet Assoc. 1997; 97:510-514.
6. Lewis LB, Sloane DC, Nascimento LM, Diamant AL, Guinyard JJ, Yancey AK *et al.* African Americans' access to healthy food options in south Los Angeles restaurants. American Journal of Public Health. 2005; 95(4):668-73. doi: 10.2105/AJPH.2004.050260
7. McIlveen H. Product Development and the QMS: An Essential Combination or a Contradiction in Terms? British Food Journal. 1994; 96(3):18-22.
8. Meiselman HL. The contextual basis for acceptance, choice and intake. In Meiselman HL. Mac Fie, H.J. H. Food choice, acceptance and consumption. London. Blackie Academic and Professional, 1996.
9. Namkung Y, Jang S. Does food quality really matter in restaurants? Its impact on customer satisfaction and behavioral intentions. Journal of Hospitality and Tourism Research. 2007; 31(3):387-410.
10. Payne-Palacio J, Theis M. Introduction to food service. 10thed. New Jersey. Pearson Prentice Hall, 2005.
11. Straete Egil Petter. Modes of qualities in development of speciality food, British Food Journal. 2008; 110(1):62-75.
12. Tandon PS, Wright J, Zhou C, Rogers CB, Christakis DA. Nutrition menu labeling may lead to lower-calorie restaurant meal choices for children. Pediatrics. 2010; 125:244-8, 21.
13. Yamamoto JA, Yamamoto JB, Yamamoto BE, Yamamoto LG. Adolescent fast food and restaurant ordering behavior with and without calorie and fat content menu information. J Adolesc. Health. 2005; 37:397-402.
14. Whitehead AJ. Elements of an effective national food control system. Food Control. 1995; 6(5):247-251.