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Nutritional Quality Analysis of Vegetable Pulav served at Selected Restaurants

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ABSTRACT

Introduction
Total food quality management has been a hard challenge for all the restaurateurs since long. Consistent quality is critical for hospitality operations. It is a hard reality that the food served at restaurants is generally high in calories, fats and carbohydrates thereby leading to malnutrition and other health related disorders like overweight, obesity, heart diseases etc. on prolonged regular consumption. 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 Vegetable Pulav served at selected restaurants
- To evaluate the nutritional adequacy of Vegetable Pulav served thereto

Methodology
The vegetable pulav 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
Vegetable pulav served at most of the studied restaurants was found to be deficient in almost all the calculated nutrients especially calories and fibre with reference to the standardized recipe. The vegetable pulav of private restaurants (R1) was higher only in carbohydrate (9 per cent) whereas that served at fast food restaurants (R3) rated higher in protein (7 per cent) and fat contents (15 per cent). However, a total decline has been noted in energy (- 41 per cent), carbohydrate (- 1.5 per cent), protein (-29 per cent), fat (-6 per cent) and fibre (-17 per cent) content of the vegetable pulav served at public restaurants (R2).

1. Introduction

Total food quality management has been a hard challenge for all the restaurateurs since long. Consistent quality is critical for hospitality operations (Jones and Dent, 1994; Crandall et al., 1996), in particular, restaurant food service operations (Bosselman, 1995). This is because customers of restaurants are more concerned with the consistency of the quality of food offered. However, providing a consistent level of food quality is a major challenging task (Walker, 2008). It is a hard reality that the food served at restaurants is generally high in calories, fats and carbohydrates thereby leading to malnutrition and other health related disorders like overweight, obesity, heart diseases etc. on prolonged regular consumption. 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 Vegetable pulav served at Selected Restaurants” has studied the primary aspects of overall quality of the food served at private, public and fast food restaurants.

2. Review of Literature

Known for menu items containing high amounts of fat, sugar, and salt, fast-food restaurants have contributed to increased risk of diet-related chronic diseases, like heart disease and diabetes."Despite qualitative evidence that the fast-food industry is making improvements to the nutritional quality of at least some of their menu items, a quantitative evaluation of trends in the nutritional quality of fast food available in the marketplace was lacking," said lead investigator Mary Hearst, Ph.D., MPH, Associate Professor of Public Health at St. Catherine University in St. Paul, Minnesota. The overall nutritional quality score associated with the eight studied restaurants came out to be 48; quite below 55 of the average American diet in general, which the USDA considers far from optimal.

One in three Americans currently suffers from unhealthy weight, which can lead to conditions such as heart disease, diabetes, and depression. The causes of obesity are not limited to individual behaviors but include environmental factors, such as the availability of healthy food outlets. Understanding the influence of the food environment is especially relevant for college students living away from home,

who consume most of their food commercially as they establish new eating habits. This study explored the quality, cost, and distribution of the food available at the University of Florida. Available food items and prices were obtained from Gator Dining Services for each dining location on campus in 2009, and the nutritional quality of the food was assessed using the Nutritional Quality Index (NQI). Food items were also coded based on location in order to determine if differences in nutritional quality existed that depend on the geographic area. Statistical analyses were conducted in order to determine if significant differences exist that are based on price and dining location. The average food item costs $ 4.26 and contains 552 calories. The data suggest that foods high in fat and cholesterol are cheaper and more readily available than healthier foods, and the availability of healthy foods varies by location on campus.

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). 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). Moreover, studies have shown that providing nutrient-dense foods at the elementary, middle, and high school level increases students' daily intake of fruits and vegetables, improving their overall nutrition (Kubik, Lytle, Hannan, Perry, and Story, 2003). These findings are reinforced by Morland, Wing, and Diez Roux's research, which demonstrated that adults were more likely to consume diets high in fruits and vegetables and low in saturated fats when supermarkets containing these foods were in close proximity (2002).

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).

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.

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). However in a study by Yamamota et al. (2005), 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).

3. 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 vegetable pulav 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 recipes were also formulated for each of the six recipes in consultation with the chefs of different restaurants and prepared by the researcher in hygienic settings. 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.

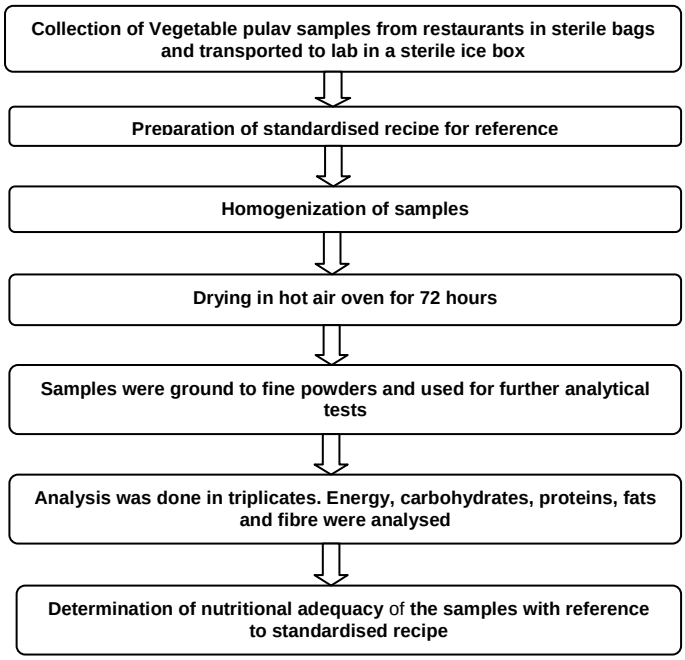

Fig. 1: Methodology for Evaluating the Nutritional Adequacy of Vegetable pulav Samples at a Glance

4. Results and Discussion

A. Evaluation of Nutritional Quality of Vegetable Pulav

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 vegetable pulav 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 Vegetable Pulav Samples

Proximate composition analysis for energy, carbohydrate, protein, fats and fibre content was done using Socsplus, Kelplus 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 Vegetable Pulav

In order to evaluate the nutritional quality of vegetable pulav served at all the selected establishments, the samples were subjected to proximate composition analysis for calculating the major nutrients namely carbohydrate, protein, fats along with fibre. The mean values of the triplicate along with standard deviations are presented in Table 1.

The mean scores for energy in vegetable pulav samples for private, public and fast food restaurants are 340.9 ± 15.28 kcal, 357.5 ± 7.08 kcal and 359.0 ± 19.58 kcal. All these values are found to be lesser than the standardized recipe which has a mean value of 372.0 ± 0.00 kcal. The mean values for the carbohydrate content of the vegetable pulav as depicted in the table are highest in private restaurants with a mean value of 56.10 ± 0.20 g and lowest in vegetable pulav served at fast food restaurants with a mean value of 41.49 ± 0.05 g. Analysis of the mean and standard deviation of vegetable pulav of the selected units showed that though energy and carbohydrates supplied by the vegetable pulav were almost similar with the standardised recipe value but there has been an increase in the fat content. Maximum fat has been found in fast food restaurants' sample with a mean value of 18.13 ± 2.05 g as compared to the standardised recipe's mean value of 15.71 ± 0.00 g. A decline was however visible in protein content in both private and public restaurants with the mean values of 4.02 ± 0.98 g and 5.06 ± 0.28 g respectively with an exception of fast food restaurants (R3) exhibiting a mean value of 7.47 ± 0.32 g as against 7.01 ± 0.00 g of the standardized recipe. There has been a downfall in the amount of fibre in the vegetable pulav of all the three types of the studied restaurants in comparison to the mean fibre of the standardized recipe (2.09 ± 0.00 g).

Table 1: Comparison of Proximate Values of Vegetable Pulav (VP) served at Private, Public and Fast Food Restaurants

VP	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	340.9	15.28	**56.10**	**0.20**	4.02	0.98	11.16	1.50	1.51	0.19
R2	357.5	7.08	50.64	0.75	5.06	0.28	14.97	0.67	1.77	0.29
R3	359.0	19.58	41.49	0.05	**7.47**	**0.32**	**18.13**	**2.05**	1.34	0.15
SR**	**372.2**	**0.00**	51.16	0.00	7.01	0.00	15.71	0.00	**2.09**	**0.00**

** Standard Deviation* *** Standardised Recipe*

i) Energy

Judgement of energy means from Table 1, of the selected restaurants disclosed that fast food restaurants (R3) have the highest mean value of 359.0 ± 19.58 kcal and private restaurants (R1) have the lowest mean value of 340.9 ± 15.28 kcal for energy and the difference between the studied restaurants and the standardised recipe value was not very

much. The calculated F-value of 1.353 (Table 2) is less than the tabulated value which means the fact that the energy values of vegetable pulav of all the three types of restaurants are approximately similar is recognized.

To further check this, results of t-test were examined, which instituted that the calculated values of t were lower than the respective tabulated values (Tables 3 to 5). Hence, the energy values of vegetable pulav served at private, public and fast food restaurants are almost similar with p-values of 0.164, 0.276 and 0.904 at 95 per cent confidence level respectively for private versus public, private versus fast food and public versus fast food restaurants. These support ANOVA outcomes of insignificant difference among the three types of restaurants.

Table 2: Analysis of variance (ANOVA) among Nutritive Value of Vegetable Pulav served at Private, Public and Fast Food Restaurants

		Sum of Squares	df	Mean Square	F	Sig.
ENERGY	Between Groups	601.446	2	300.723	1.353	.327
	Within Groups	1333.817	6	222.303		
	Total	1935.262	8			
CARBOHYDRATE	Between Groups	327.120	2	163.560	810.282	.000**
	Within Groups	1.211	6	.202		
	Total	328.331	8			
PROTEIN	Between Groups	18.822	2	9.411	24.977	.001*
	Within Groups	2.261	6	.377		
	Total	21.083	8			
FATS	Between Groups	73.002	2	36.501	15.847	.004*
	Within Groups	13.820	6	2.303		
	Total	86.822	8			
FIBRE	Between Groups	.281	2	.141	2.935	.129
	Within Groups	.288	6	.048		
	Total	.569	8			

Significant at p ≤ 0.05* * Significant at p ≤ 0.001*

ii) Carbohydrate

The mean values of carbohydrate component from Table 1 of the studied restaurants showed that private restaurants (R1) have the highest mean value of 56.10 ± 0.20 g and fast food restaurants (R3) have the lowest mean value of 41.49 ± 0.05 g for carbohydrates in vegetable pulav. The calculated F-value of 810.282 (Table 2) is much greater than the tabulated value which endorses the highly significant difference of vegetable pulav served at the three types of restaurants.

Results of t-test were appraised to prove this. The calculated values of t were higher than the respective tabulated values (Tables 3 to 5) with a p-value of 0.000 at 99 per cent confidence level in all the three comparisons thereby sustaining ANOVA results of high significance.

iii) Protein

Means of protein component from Table 1 of the selected units revealed that fast food restaurants (R3) have the highest mean value of 7.47 ± 0.32 g and private restaurants (R1) have the lowest mean value of 4.02 ± 0.98 g for protein and a large difference exists among private, public and fast food restaurants. The calculated F-value of 24.977 (Table 2) is higher than the tabulated value which holds that the protein content of vegetable pulav served at these three types of restaurants differ significantly.

Results of t-test were inspected to establish this. The results ascertained that the calculated values of t were lower than the respective tabulated values in case of private versus public, private versus fast food and public versus fast food (Tables 3 to 5) but the p-values at 95 per cent confidence level mark the significant difference only between private versus fast food restaurants (p-value 0.004) and public versus fast food restaurants (p-value 0.001). However, no such significance was observed between private versus public restaurants (Tables 3 to 5). These results are in accordance with the ANOVA outcomes also.

Table 3: Comparison of Nutritive Value of Vegetable Pulav served at Private and Public Restaurants

		t	df	Sig. (2-tailed)
ENERGY	Equal variances assumed	-1.699	4	.164
	Equal variances not assumed	-1.699	2.821	.194
CARBOHYDRATE	Equal variances assumed	12.186	4	.000**
	Equal variances not assumed	12.186	2.283	.004*
PROTEIN	Equal variances assumed	-1.780	4	.150
	Equal variances not assumed	-1.780	2.334	.199
FATS	Equal variances assumed	-4.001	4	.016*
	Equal variances not assumed	-4.001	2.755	.033*
FIBRE	Equal variances assumed	-1.286	4	.268
	Equal variances not assumed	-1.286	3.482	.277

Significant at p ≤ 0.05* * Significant at p ≤ 0.001*

Table 4: Comparison of Nutritive Value of Vegetable Pulav served at Private and Fast Food Restaurants

		t	df	Sig. (2-tailed)
ENERGY	Equal variances assumed	- 1.260	4	.276
	Equal variances not assumed	- 1.260	3.777	.280
CARBOHYDRATE	Equal variances assumed	122.728	4	.000**
	Equal variances not assumed	122.728	2.252	.000**
PROTEIN	Equal variances assumed	- 5.836	4	.004*
	Equal variances not assumed	- 5.836	2.415	.018*
FATS	Equal variances assumed	- 4.745	4	.009*
	Equal variances not assumed	- 4.745	3.670	.011*
FIBRE	Equal variances assumed	1.214	4	.292
	Equal variances not assumed	1.214	3.712	.296

*Significant at p ≤ 0.05 ** Significant at p ≤ 0.001

iv) Fats

An assessment of fat means from Table 1 of the selected units exhibited that fast food restaurants (R3) have the highest mean value of 18.13 ± 2.05 g and private restaurants (R1) have the lowest mean value of 11.16 ± 1.50 g for fats and the difference amongst them is small. The calculated F-value of 15.847 (Table 2) is higher than the respective tabulated value at 95 per cent confidence level which clarifies that the fats content of vegetable pulav of all the three types of restaurants is slightly different.

To further check this, results of t-test were evaluated. It was found that the calculated values of t were lower than the respective tabulated values. The p-values of 0.016 and 0.09 at 95 per cent confidence level advocated the significant difference between private versus public restaurants (Table 3) as well as private versus fast food restaurants (Table 4). No such significant p-values are however observed at case of public versus fast food restaurants leading to the fact that public and fast food units serve vegetable pulav with almost similar fat content (Table 5). These conclusions support the ANOVA results.

Table 5: Comparison of Nutritive Value of Vegetable Pulav served at Public and Fast Food Restaurants

		t	df	Sig. (2-tailed)
ENERGY	Equal variances assumed	-.128	4	.904
	Equal variances not assumed	-.128	2.514	.908
CARBOHYDRATE	Equal variances assumed	21.074	4	.000**
	Equal variances not assumed	21.074	2.018	.002*
PROTEIN	Equal variances assumed	-9.848	4	.001*
	Equal variances not assumed	-9.848	3.953	.001*
FATS	Equal variances assumed	-2.544	4	.064
	Equal variances not assumed	-2.544	2.417	.104
FIBRE	Equal variances assumed	2.286	4	.084
	Equal variances not assumed	2.286	2.941	.108

*Significant at p ≤ 0.05 ** Significant at p ≤ 0.001

v) Fibre

Fibre means from Table 4.2.1.3 of the studied establishments exposed that public restaurants (R2) have the maximum mean value of 1.77 ± 0.29 g and fast food restaurants (R3) have the minimum mean value of 1.34 ± 0.15 g for fibre and none of them has been able to meet the standardised recipe value. The calculated F-value of 2.935 (Table 4.2.2.3) is lesser than the tabulated value which opines that there is not any significant difference in the fibre values of vegetable pulav served thereto.

Outcomes of t-test were also checked to validate. The results marked that the calculated t values were lower than the respective tabulated values hence proving the insignificant difference of fibre content of the studied restaurants (Tables 4.4.3.7 to 4.4.3.9). The p-values of 0.268, 0.292 and 0.084 at 95 per cent confidence level signify the insignificant relation amongst the private, public and fast food restaurants. These results are also in line with ANOVA outcomes.

B. Checking Nutritional Adequacy of Vegetable Pulav

Figure 2 illustrates the percent variation in the nutritive value of vegetable pulav served at private, public and fast food restaurants amongst each other and with the standardized recipe values. The bar graph highlight that vegetable pulav served at most of the studied restaurants was found to be deficient in almost all the calculated nutrients especially calories and fibre with reference to the standardized recipe. The vegetable pulav of private restaurants (R1) was higher only in carbohydrate (9 per cent) whereas that served at fast food restaurants (R3) rated higher in protein (7 per cent) and fat contents (15 per cent). However, a total decline has been noted in energy (- 41 per cent), carbohydrate (- 1.5 per cent), protein (-29 per cent), fat (-6 per cent) and fibre (-17 per cent) content of the vegetable pulav served at public restaurants (R2).

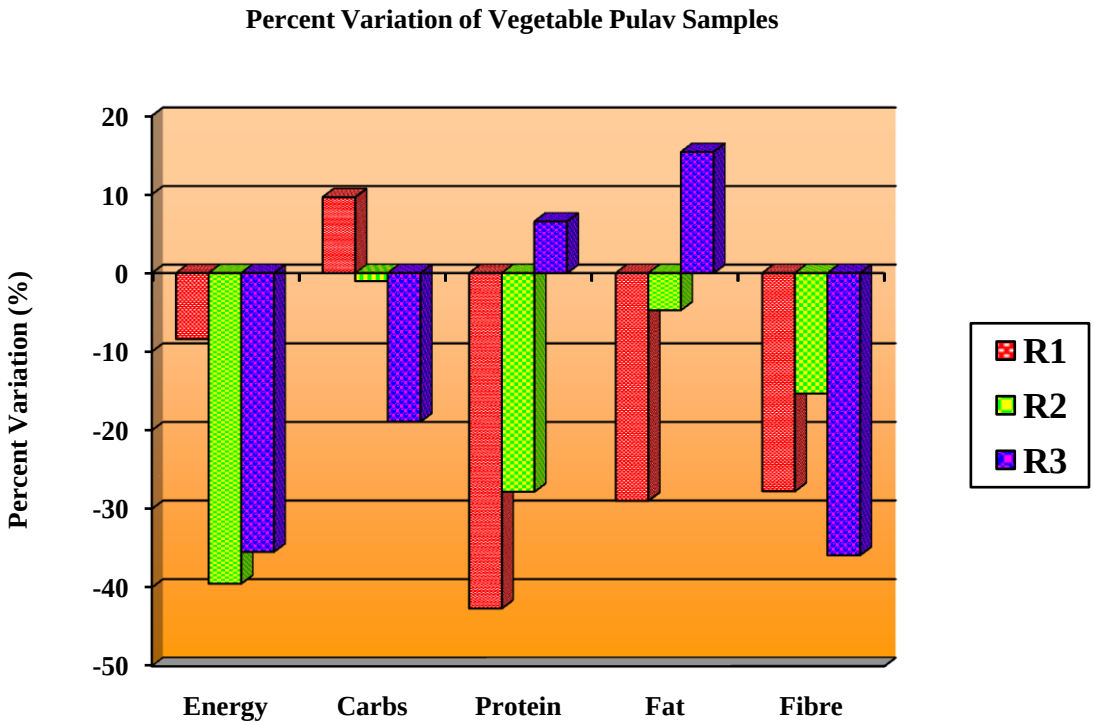

Fig. 2: Percent Variation in Nutritional Adequacy of Vegetable Pulav served at Private, Public and Fast Food Restaurants

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