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A DIP OF TOMATO SAUCE – NUTRACEUTICAL

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ABSTRACT

Tomato sauce is one of the most sought after food product across the globe. Though tomato is a rich source of anti-oxidant it is not available fully in the tomato sauce due to the presence of wide range of food additives viz., sodium benzoate, pimaricin, as preservatives; Sulphites and allura red and erythrosine as colorants ; Sodium diacetate as stabilizer and flavour enhancer ; formic acid as oxidisable substance.So the present study was undertaken with an objective to increase the nutritional content and eliminate the artificial additives by natural additives like spices and herbs. In the following study we prepared four combinations of tomato sauce. Protein and thiamine content was estimated by analytical methods. Besides sensory analysis was done by IBM SPSS statistics software 19. The result showed that the protein and thiamine content was highest in sample 3 (sauce prepared with carrot *(Daucus carota)* along with Tomato*(Solanum lycopersicum)*) *followed by sample 4* (sauce prepared with bottlegourd *(Lagenaria Siceraria)* along with Tomato *(Solanum lycopersicum))*.After the statistical analysis, it was found that a combination of bottle gourd and tomato was most favoured .

Keywords: Protein estimation, Lowry method, thiamine estimation, Herbs and spices, anova , frequency , correlation.

INTRODUCTION

Sauces are the semi solid food,which are generally used as condiment since they add flavor and visual appearance to the food. The most widely used sauce is tomato sauce since tomatoes have rich flavor and taste.Beside tomatoes contain lycopene - a well proven anti-oxidant(Heinz Institute of Nutritional Sciences) and antioxidants are reported to play major role in alleviation of most of the life style diseases.Eating 10 spoonsof tomato sauce a week can reduce the riskof prostrate cancerby 40%-50%(Dr Tim Key, of Cancer Research UK).But the nutritive property of tomato sauce is masked by various synthetic additives used in the preparation.Hence this study was undertaken to substitute the artificial additives with natural preservative like spices (clove,cinnamon,blackpepper).In recent years the anti-oxidant potential of spices and herbs have been clinical proven to combat the life style diseases for example-blackpepper has a remarkable anti – inflammatory property and it increases digestion(nutrition blog powered by the sitesell.com).In addition the present study included the incorporation of vegetables like Bottle gourd,Carrot and fruit like pomegranate because of the following benefits reported for these components.For example Bottle gourd(*Lagenaria Siceraria*) is an excellent component of light and low-cal diets. Due to this,it is prescribed for diabetic patient .Similarly carrot helps in protecting as well as nourishing the skin and eyes due to presence of β carotene. Pomegranate - stimulates appetite and is used in treatment of stomach disorders.

MATERIALS AND METHODS

SAMPLE PREPARATION

Samples were prepared using following vegetables and fruits.

Sample 1 was market tomato sauce which was control, sample 2 was homemade tomato sauce , sample 3 was a mixture of tomato with carrot , sample 4 contains tomato with bottlegourd whereas sample 5 was a mixture of tomato with pomegranate. These samples were used for further analysis.

PREPARATION OF SAUCES

PREPARATION OF TOMATO SAUCE

Tomatoes were washed, cut and peels were removed by boiling and then mashed. ½ teaspoon of vegetable oil and chopped onion is added in fry pan then it is fried for 1 minute, after this tomato paste and salt was added to this mixture according to taste. Then the paste of 4 piece of garlic,2 green chilly, ½ teaspoon of black pepper powder, ½ teaspoon of carom,4-cloves, Cinnamon-1,cardamom- 3 was made and the paste was added to the tomato fried paste containing ½ spoon of vinegar. Besides

3-4 teaspoons of sugar was added and mixture was boiled for 5-10 minutes until it became thick and then cooled.

PREPARATION OF TOMATO-CARROT SAUCE

To the base preparation of tomato sauce, carrot paste was added.

PREPARATION OF TOMATO-BOTTLE GOURD SAUCE

To the base preparation of tomato sauce, bottle-gourd paste was added.

PREPARATION OF POMEGRANATE-TOMATO SAUCE

To the base preparation of tomato sauce, pomegranate paste was added.

- In the above mentioned samples, protein was estimated by Lowry's method (Wilson K. And Walker J (2000)) whereas thiamine was estimated by (Flourimetric method) (Biochemical Methods by S Sadasivam, A. Manickam -1996)
- Sensory analysis was done by IBM SPSS statistics software 19. In this analysis we have taken following parameter viz. visual appearance, sweetness, saltiness, spicy and sour.

ANOVA

Null hypothesis: $\mu1 = \mu2$ (for each case compared with Sample1 (control))

Alternate hypothesis $\mu1 \neq \mu2$ (for each case compared with Sample1 (control)

Fig. 1a - Comparison for factor no 1: Visual Appearance

ANOVA						
		Sum of Squares	**Df**	**Mean Square**	**F**	**Sig.**
Sample2	Between Groups	10.807	2	5.403	9.177	.000
	Within Groups	27.673	47	.589		
	Total	38.480	49			
Sample3	Between Groups	15.047	2	7.523	12.704	.000
	Within Groups	27.833	47	.592		
	Total	42.880	49			
Sample4	Between Groups	6.247	2	3.123	3.392	.042
	Within Groups	43.273	47	.921		
	Total	49.520	49			
Sample5	Between Groups	5.087	2	2.543	3.720	.032
	Within Groups	32.133	47	.684		
	Total	37.220	49			

Null hypothesis is rejected for Sample 2 and 3, So there is no similarity between sample 1, 2 and 3 whereas null hypothesis is accepted for sample 4 and 5 so there is similarity between visual appearance of sample 1,4 and 5.

Fig.1b - Comparison for factor no 2: Sweetness

ANOVA						
		Sum of Squares	**Df**	**Mean Square**	**F**	**Sig.**
Sample2	Between Groups	14.363	3	4.788	6.563	.001
	Within Groups	33.557	46	.729		
	Total	47.920	49			
Sample3	Between Groups	8.713	3	2.904	3.670	.019
	Within Groups	36.407	46	.791		
	Total	45.120	49			
Sample4	Between Groups	7.343	3	2.448	3.324	.028
	Within Groups	33.877	46	.736		
	Total	41.220	49			
Sample5	Between Groups	11.353	3	3.784	6.553	.001
	Within Groups	26.567	46	.578		
	Total	37.920	49			

Null hypothesis is rejected for Sample 2 and 5,so there is no similarity between sample 1,2 and 5 whereas null hypothesis is accepted for sample 3 and 4 so there is similarity between sweetness of sample 1,3 and 4.

Fig.1c - Comparison for factor no 3.SALTINESS

ANOVA						
		Sum of Squares	**Df**	**Mean Square**	**F**	**Sig.**
Sample2	Between Groups	5.933	3	1.978	3.703	.018
	Within Groups	24.567	46	.534		
	Total	30.500	49			
Sample3	Between Groups	2.257	3	.752	.871	.463
	Within Groups	39.743	46	.864		
	Total	42.000	49			

Sample4	Between Groups	4.244	3	1.415	2.211	.100
	Within Groups	29.436	46	.640		
	Total	33.680	49			
Sample5	Between Groups	1.018	3	.339	.607	.614
	Within Groups	25.702	46	.559		
	Total	26.720	49			

null hypothesis is accepted for sample 2,3,4 and 5 so there is similarity between saltiness of sample 1,2,3,4 and 5.

Fig. 1d - Comparison for factor no.4 Spicy

ANOVA						
		Sum of Squares	**Df**	**Mean Square**	**F**	**Sig.**
Sample2	Between Groups	14.904	4	3.726	7.204	.000
	Within Groups	23.276	45	.517		
	Total	38.180	49			
Sample3	Between Groups	11.506	4	2.876	4.081	.007
	Within Groups	31.714	45	.705		
	Total	43.220	49			
Sample4	Between Groups	4.853	4	1.213	1.842	.137
	Within Groups	29.647	45	.659		
	Total	34.500	49			
Sample5	Between Groups	5.025	4	1.256	1.868	.133
	Within Groups	30.255	45	.672		
	Total	35.280	49			

Null hypothesis is rejected for Sample 2 ,so there is no similarity between sample 1 and ,2 whereas null hypothesis is accepted for sample 3,4 and 5 so there is similarity between spicy of sample 1,3,4 and5.

Fig.1e - Comparison for factor no.5: SOUR

ANOVA						
		Sum of Squares	**Df**	**Mean Square**	**F**	**Sig.**
Sample2	Between Groups	8.167	4	2.042	3.243	.020
	Within Groups	28.333	45	.630		
	Total	36.500	49			
Sample3	Between Groups	7.145	4	1.786	1.967	.116
	Within Groups	40.875	45	.908		
	Total	48.020	49			
Sample4	Between Groups	0.773	4	.193	.186	.945
	Within Groups	46.847	45	1.041		
	Total	47.620	49			
Sample5	Between Groups	6.824	4	1.706	2.017	.108
	Within Groups	38.056	45	.846		
	Total	44.880	49			

null hypothesis is accepted for sample2, 3,4 and 5 so there is similarity between sourness of sample 1,2,3,4and 5.

Fig.1f - Comparison for factor no.6: Mouth feel

ANOVA						
		Sum of Squares	**Df**	**Mean Square**	**F**	**Sig.**
Sample2	Between Groups	11.806	3	3.935	4.933	.005
	Within Groups	36.694	46	.798		
	Total	48.500	49			
Sample3	Between Groups	23.030	3	7.677	17.233	.000
	Within Groups	20.490	46	.445		
	Total	43.520	49			
Sample4	Between Groups	6.602	3	2.201	4.417	.008
	Within Groups	22.918	46	.498		
	Total	29.520	49			
Sample5	Between Groups	2.606	3	.869	2.027	.123
	Within Groups	19.714	46	.429		
	Total	22.320	49			

Null hypothesis is rejected for Sample 2,3, so there is no similarity between sample 1,2 and 3 whereas null hypothesis is accepted for sample 4 and 5 so there is similarity between mouthfeel of sample 1,3 and 4.

FREQUENCY, MEAN, MEDIAN, MODE, RANGE, STANDARD DEVIATION

Fig.2a - Comparison for factor no.1 visual appearance

Statistics						
		Sample1	Sample2	Sample3	Sample4	Sample5
N	Valid	50	50	50	50	50
	Missing	0	0	0	0	0
Mean		4.2000	3.4800	3.3200	3.3600	3.3400
Std. Error of Mean		.12454	.12532	.13230	.14217	.12326
Median		4.5000	4.0000	3.0000	3.0000	3.0000
Mode		5.00	4.00	3.00	3.00	3.00
Std. Deviation		.88063	.88617	.93547	1.00529	.87155
Range		2.00	4.00	4.00	4.00	4.00

Pie charts showing comparison for visual appearance.

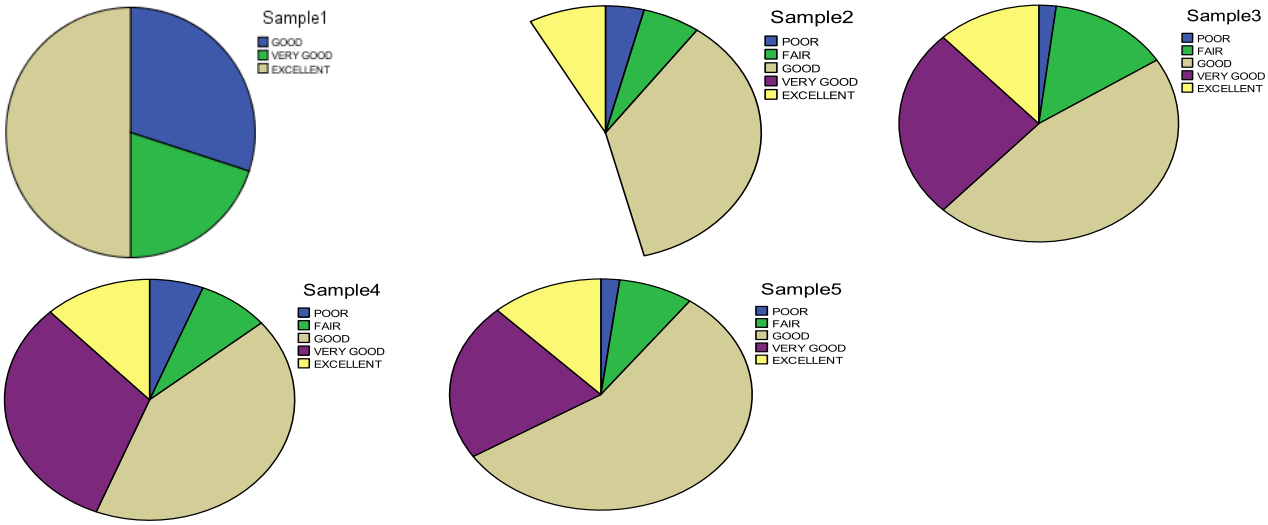


Fig. 2b - Comparison for factor no.2 SWEETNESS

Statistics						
		Sample1	Sample2	Sample3	Sample4	Sample5
N	Valid	50	50	50	50	50
	Missing	0	0	0	0	0
Mean		3.5400	3.0400	2.7600	2.6600	2.9600
Std. Error of Mean		.11503	.13985	.13571	.12971	.12441
Median		4.0000	3.0000	3.0000	2.0000	3.0000
Mode		4.00	4.00	2.00	2.00	3.00
Std. Deviation		.81341	.98892	.95959	.91718	.87970
Range		3.00	4.00	4.00	3.00	4.00

Pie charts showing comparison for sweetness

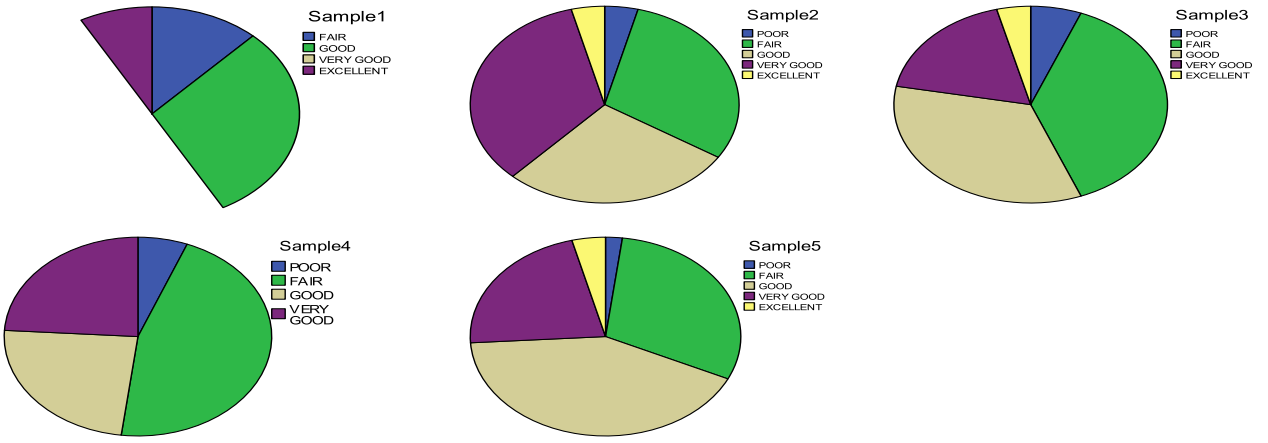


Fig.2c - Comparison for factor no.3 SALTINESS

Statistics						
		Sample1	Sample2	Sample3	Sample4	Sample5
N	Valid	50	50	50	50	50
	Missing	0	0	0	0	0
Mean		3.2600	3.3000	3.4000	3.0800	3.1600
Median		3.0000	3.0000	3.0000	3.0000	3.0000
Mode		4.00	3.00	3.00	3.00	3.00
Std. Deviation		.87622	.78895	.92582	.82906	.73845
Range		3.00	3.00	3.00	4.00	3.00

Pie charts showing comparison for saltiness.

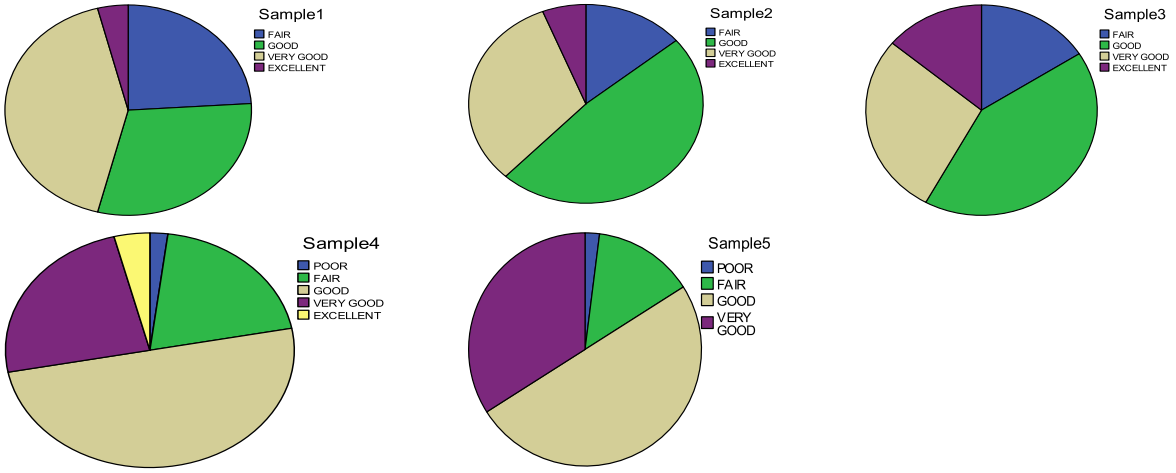


Fig.2d -Comparison for factor no.4 SPICY

Statistics						
		Sample1	**Sample2**	**Sample3**	**Sample4**	**Sample5**
N	Valid	50	50	50	50	50
	Missing	0	0	0	0	0
Mean		2.9200	3.4200	3.3400	3.3000	3.1200
Std. Error of Mean		.16373	.12483	.13282	.11867	.12000
Median		3.0000	3.5000	3.0000	3.0000	3.0000
Mode		3.00	4.00	3.00	3.00	3.00
Std. Deviation		1.15776	.88271	.93917	.83910	.84853
Range		4.00	4.00	4.00	3.00	4.00

Pie charts showing comparison for spicyness.

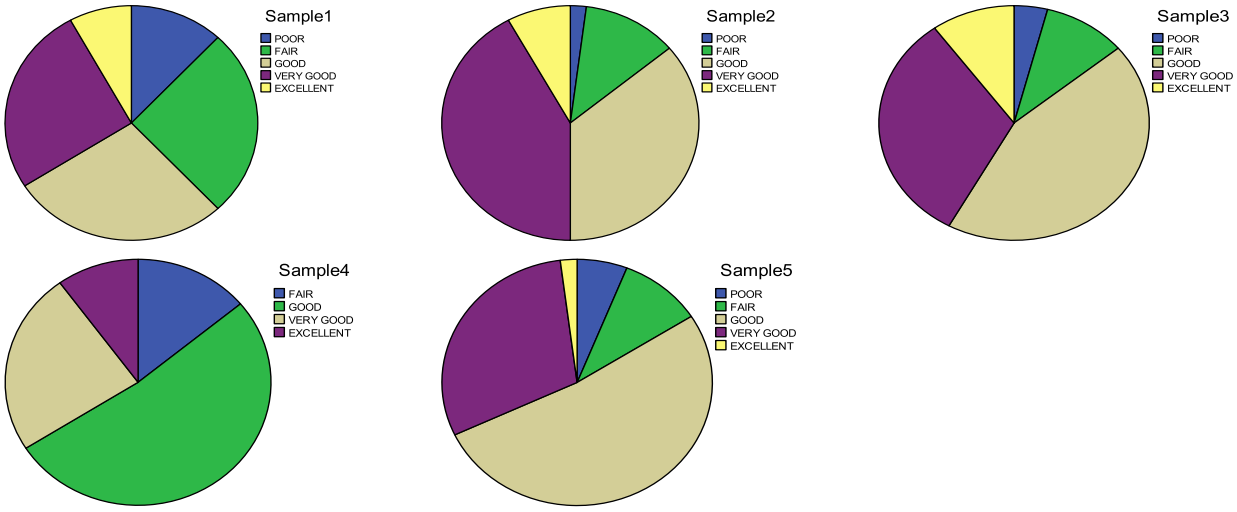


Fig.2e Comparison for factor no.5 SOUR

STATISTICAL ANALYSIS

Statistics						
		Sample1	**Sample2**	**Sample3**	**Sample4**	**Sample5**
N	Valid	50	50	50	50	50
	Missing	0	0	0	0	0
Mean		2.6600	3.1000	3.1400	3.2600	3.3200
Median		2.0000	3.0000	3.0000	3.0000	4.0000
Mode		2.00	3.00[a]	4.00	3.00	4.00
Std. Deviation		.98167	.86307	.98995	.98582	.95704
Range		4.00	3.00	4.00	4.00	4.00

Pie charts showing comparison for sourness.

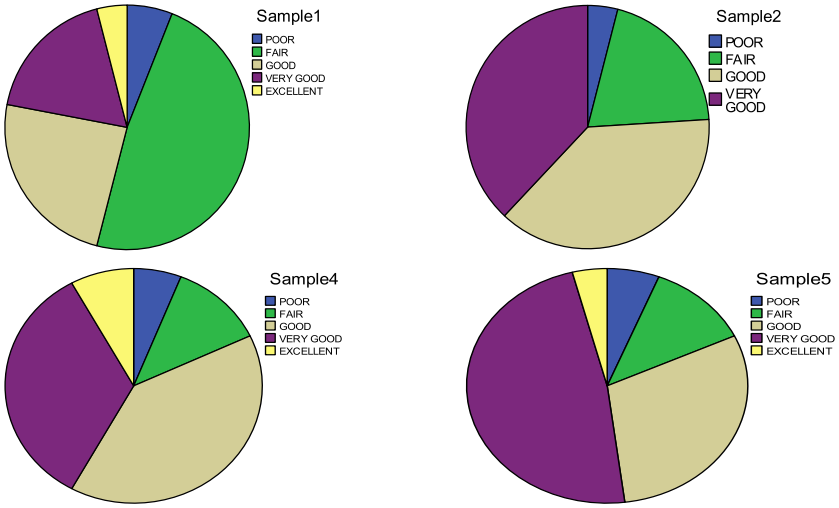
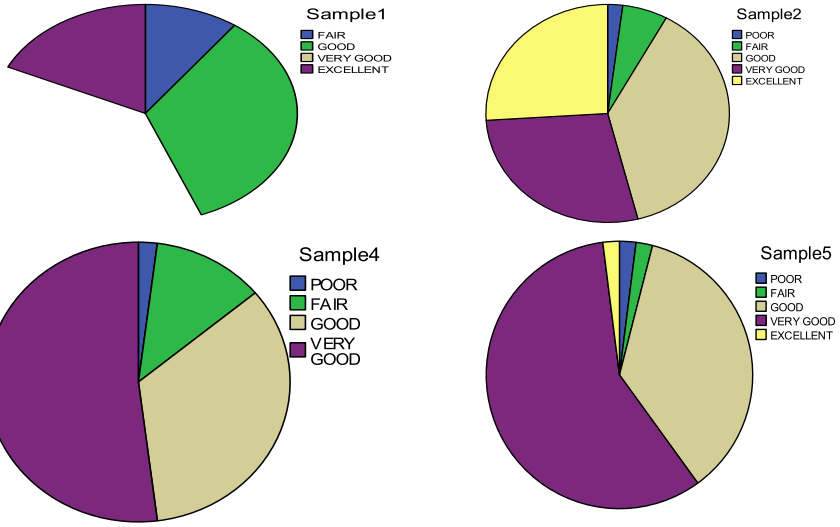


Fig.2f - Comparison for factor no.6 MOUTHFEEL

Statistics						
		Sample1	**Sample2**	**Sample3**	**Sample4**	**Sample5**
N	Valid	50	50	50	50	50
	Missing	0	0	0	0	0
Mean		4.2000	3.4800	3.3200	3.3600	3.3400
Std. Error of Mean		.12454	.12532	.13230	.14217	.12326
Median		4.5000	4.0000	3.0000	3.0000	3.0000
Mode		5.00	4.00	3.00	3.00	3.00
Std. Deviation		.88063	.88617	.93547	1.00529	.87155
Range		2.00	4.00	4.00	4.00	4.00

Pie charts showing comparison for Mouthfeel factor



CORREALATION
Null hypothesis-r=0
Alternative hypothesis-r<>0

Paired sample correlation		N	correlation	Sig	correlation	sig	correlation	sig
			Sweetness		Saltiness		Spicy	
Pair 1	Sample1 & Sample2	50	0.480	0.000	0.416	0.003	0.613	0.000
Pair 2	Sample1 & Sample3	50	0.405	0.004	0.221	0.122	0.495	0.000
Pair 3	Sample1 & Sample4	50	0.251	0.079	0.336	0.017	0.235	0.100
Pair 4	Sample1 & Sample5	50	0.459	0.001	0.155	0.282	0.363	0.010

1. For Sweetness : Null hypothesis accepted for pair 2 and 3 so there is no significant linear correlation and null hypothesis is rejected for pair 1 and 4 so there is significant positive linear correlation
2. For Saltiness: Null hypothesis is accepted for pair 1,2,3,4 so there is no significant linear correlation.
3. For Spicy : Null hypothesis accepted for pair 4 so there is no significant linear correlation and null hypothesis is rejected for pair 1,2 and 3 so there is significant positive linear correlation.

Paired sample correlation		N	correlation	Sig	correlation	sig	correlation	sig
			Visual appearance		Sour		Mouth feel	
Pair 1	Sample1 & Sample2	50	0.528	0.000	0.354	0.012	0.493	0.000
Pair 2	Sample1 & Sample3	50	0.590	0.000	0.302	0.033	0.663	0.000
Pair 3	Sample1 & Sample4	50	0.355	0.011	0.072	0.619	0.424	0.002
Pair 4	Sample1 & Sample5	50	0.362	0.010	0.162	0.262	0.306	0.031

1. For visual appearance: Null hypothesis is rejected for pair 1, 2, 3, 4 ie there is significant positive linear correlation
2. For Sour: Null hypothesis is accepted for pair 1,2,3 and 4 so there is no significant linear correlation.
3. For Mouthfeel :Null hypothesis accepted for pair 3 and 4 so there is no significant linear correlation and null hypothesis is rejected for pair 1 and 2 so there is significant positive linear correlation.

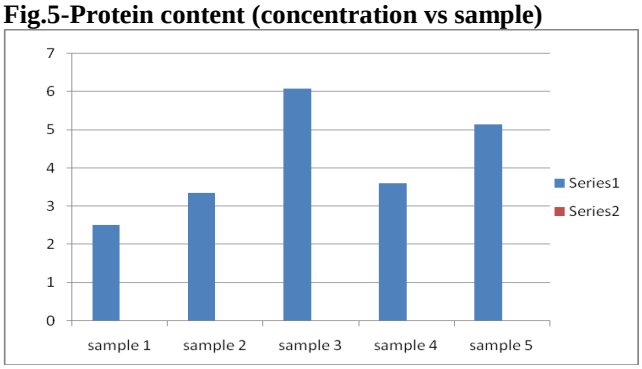
RESULT AND DISCUSSION

The results (FIG. 4 and FIG.5) showed that the protein and thiamine content was highest in Sample 3 (sauce prepared with carrot *(Daucus carota)* along with Tomato *(Solanum lycopersicum)*) *followed by sample 4* (sauce prepared with bottlegourd *(Lagenaria Siceraria)* along with Tomato *(Solanum lycopersicum)* . However sensory analysis showed that Sample4 was most favoured. In our study we tried to make a sauce in which we can increase the thiamine and protein content so that it will be beneficial for health along with the taste. Thiamine which is vitamin B1 is an essential nutrient , its deficiency can cause beri – beri disease which mainly disturb the peripheral nervous system , Even thiamine is involved in the progression of alzheimer's disease as it helps in biosynthesis of acetylcholine and gamma-aminobutyric acid that are neurotransmitter and if they are not synthesized than chances of occuring dementia increases. Hence thiamine is an important vitamin. Also we checked the protein content, proteins are the building blocks of human body and deficiency of proteins can cause many unusual symptoms such as –skin becomes pale or it can have rashes, wound healing becomes slow , hairs become brittle etc.So sample 3 of our experiments showed the presence of high protein and thiamine which will help in maintaining the nutrients level in body. Also we performed the nutritional analysis of sample 3 (tomato with bottlegourd) with 50g sample quantity.

Fig 4 -Ingredients analysis

Tests	Results Obtained
Moisture	79.45%
Total Ash	2.06%
Crude Fibre	0.67%
Fat	2.79%
Protein (N x 6.25)	1.00%
Carbohydrates by difference	14.03%
Energy (Food calories per 100 gm sample)	88.15

Fig.5-Protein content (concentration vs sample)



THIAMINE ESTIMATION

Formula used:

µg thiamine content in 100g sample= (0.25*10/a-a')*(((x-x')*100)/10)*(10/5)

a=reading of standard=13.761

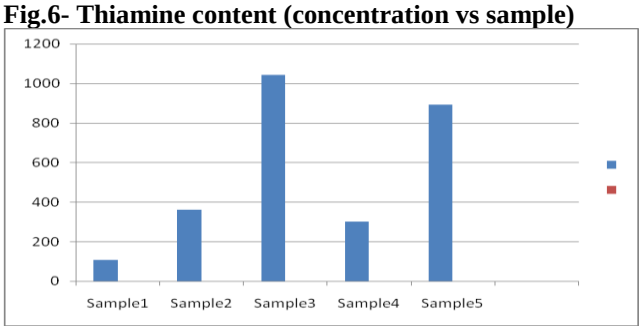
a'=reading of standard blank=0

x=reading of standard sample

x'=reading of standard sample blank

thiamine content is highest in sample 3.

Fig.6- Thiamine content (concentration vs sample)



CONCLUSION

The present study clearly demonstrates that healthy ingredients of plant origin can be successfully incorporated in the existing food items without compromising the sensory quality. These spices not only play an important role in increasing the sensory quality but also help in preserving the nutritional value of tomato. This will help in waiving the side effects of synthetic preservatives and colorants used in market tomato sauce, many of the people suffer from allergies due to the synthetic ingredients present in tomato sauce. In our experiments we used all natural ingredients to prepare the tomato sauce and we tried to maintain the sensory quality, visual appearance and nutritional value. Also according to the ingredients analysis there is 88.15 Energy (Food calories per 100 gm sample).

To the author's knowledge this is the first report of incorporating bottlegourd and carrot as ingredients in the tomato sauce.

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