Quality Evaluation and Value Addition of Exotic Street Foods: Spring Roll

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Abstract: ***The Indo-Chinese delicacy "Spring roll" is a large variety of filled, rolled appetizers or dim sum found in East Asian, South Asian, and Southeast Asian cuisine. The kind of wrapper, fillings, and cooking technique used, as well as the name, vary considerably within this large area, depending on the region's culture. Spring rolls are savory fried rolls with cabbage and other vegetable fillings inside a thinly wrapped cylindrical pastry made from refined wheat flour. In the present study, an attempt has been made to evaluate the spring roll available in the local market and then their value addition. Parameters studied physico-chemical characteristics, functional properties, proximate composition, nutritional and organoleptic acceptability. Three types of samples a were taken for study purpose. Samples were procured from local street food vendors Control samples prepared in the laboratory and value addition was done by adding locally available food material. Results of the study revealed that value addition resulted in an increase in protein content, ether extract, calorific value, Mineral content and DPPH whereas total carbohydrates, starch free fatty acids and peroxide value decreased. Value addition was found to be helpful in improving the nutritional profiling of spring rolls.***

Keywords: Calorific value, Mineral content, Nutritional evaluation, Protein content, Street Foods, Spring rolls, Value addition

1. Introduction

The concept of traditional street foods has acquired new dimensions in developed as well as under developing countries offering a variety of exotic street food with the local taste. Apparently, in the cities of developing countries, diverse food items of plant and animal origin are commonly vended at the areas with busy economic activities and massive movement of people covering schools, factories, hospitals, transportation centers, large construction sites, temples etc. (Muleta and Ashinafi, 2001). This street food vendor serves a variety of Indian and Continental foods. Street foods might be low in nutrients and can harm health of the consumer (Sezgin et al.2006 There are many street foods which are consumed by people but have not been explored nutritionally *and spring rolls are one of them.*

Spring roll is a variety of filled, rolled appetizers or dim sum found in East Asian, South Asian, and Southeast Asian cuisine. The name is a literal translation of the Chinese "chūn juǎn". The kind of wrapper, fillings, and cooking technique used, as well as the name, vary considerably within this large area, depending on the region's culture. In Chinese cuisine, spring rolls are savory rolls with cabbage and other vegetable fillings inside a thinly wrapped cylindrical pastry. They are usually eaten during the Spring Festival in mainland China, hence the name. Fried spring rolls are generally small and crisp. They can be sweet or savory; the former often with red bean paste filling, and the latter are typically prepared with vegetables. They are fully wrapped before being pan-fried or deep-fried. Spring rolls are one of the continental street food liked by young generation. Street foods play an important role in the human diet. In the present study, an attempt has been made to analyze the functional properties and nutritional quality of spring rolls sold by local food vendors. Efforts have also been made to analyze the nutritional quality of value added spring rolls by replace the basic ingredients with locally available raw food material.

2. Material and Methods

The experiment was conducted during the year 2017-2019, India. Samples of spring rolls were procured from local street food vendors of Palampur city of Himachal Pradesh. Control (following the traditional recipe) and value-added (by modifying the traditional ingredients of the recipe with locally available material) version of the spring rolls was prepared. The samples were dried to make them moisture free by placing them into hot air oven at a temp. of 60˚C for 8hrs and grounded into a fine powder. Ground samples were stored in air tight glass containers till the further analysis was complete. All sample were evaluated for various physico-chemical characteristics. functional properties, proximate composition, nutritional and microbiological quality to see the nutrition difference between them. Ingredients used for making controlled and value added samples is given in table 1

For preparing value added Spring rolls the traditional recipe was followed by replacing refined flour with wheat flour, Bengal gram and rice flour in the ratio 2: 1: 1. The stuffing of the Spring roll was amended by adding sprouts (Bengal gram + green gram) and soya chunk (grounded).

The stepwise procedure for the preparation of spring rolls is as follow:

- Weighing of ingredients as mentioned in the above table 1.
- Sifted wheat flour, rice flour, Bengal gram flour and salt (twice)
- Added water and made a dough
- Sheeting the dough into thin sheets (3mm thickness)
- Filled sheet with stuffing

- Rolled into characteristic cylindrical shapes
- Deep frying

Water Absorption Capacity and Oil absorption Capacity was analyzed by the method of (Sosulski and Garratt, 1976) and (Lin et. al., 1974), respectively.

The proximate constituents viz moisture content ash content ether extract and nitrogen content was estimate according to method of AOAC. (1992). Nitrogen was multiplied with a factor of 6.25 to convert it to crude protein.

Calorific value was estimated by method of O'shea and Maguire 1962, starch (Clegg, 1956), non-protein nitrogen (Pellet and young, 1980), true protein content was calculated by using formula: True protein= (Crude protein Nitrogen-NPN) X6.25, Reducing sugars, non-reducing sugars, total sugars were estimated by method of Yemn and Willis, 1954, ADF and NDF (Van Soest and Wine, 1967), Hemicellulose (NDF-ADF), peroxide value (AOAC 1999), free fatty acids (AOCS, 1998), anti-oxidant activity (Miliauskas et al., 2008), (Khalaf et al., 2004).

Minerals i.e., phosphorus was analyzed by the method (Chen et al., 1956), Determination of zinc and iron was done by using the atomic absorption spectrophotometer, Model 3100, Perkin Elmer. Calcium was detected by using the flame photometer, Mediflame, 127.

The samples were appraised organoleptically for the parameters like colour, taste, flavor, texture, and overall acceptability with the help of ten semi-trained panelists using a 9-point hedonic scale. The index of acceptance (IA %) was measured by using the following equation (Schumacher et al., 2010).
Index of Acceptance (%) = M/9 X100
Where, M = the average of the evaluations carried out by the sensory panel.

The attained data was possessed to Analysis of Variance (ANOVA) using OP stat software and was interpreted at 5 % level of significance ($p \leq 0.05$).

3. Results and Discussion

Functional properties:
Table 2 depicts the functional properties i. e water absorption and oil absorption capacity of Spring roll. Functional properties of food depicts how it will behave during cooking and processing.

The water absorption capacity of control, street vendor and value-added sample of *Spring roll* was 2.23, 2.89 and 2.33ml/g, respectively. A significant difference in absorption capacity was observed in street vendor and value-added samples of *Spring roll* and also in street vendor and control samples. A non-significant ($p \leq 0.05$) difference was observed in the control and value-added sample of *Spring roll*. The samples procured from street vendor was had maximum water absorption capacity than the rest of the samples. T his difference might have been due to difference in raw ingredients.

The oil absorption capacity of control, street vendor and value-added samples of *Spring roll* was 0.26, 0.98 and 2.03 ml/g, respectively. Value added sample was found to have significantly ($p \leq 0.05$) higher content of oil absorption capacity when compared with control and street vendor samples. Whereas a non-significant ($p \leq 0.05$) difference was observed among the oil absorption capacities of control and street vendors samples when compared with each other.

Proximate composition: Table 3 shows the proximate composition of the samples. According to the data obtained the moisture content of the control, street vendor and value-added sample was 6.28, 10.28 and 5.87 per cent, respectively. There was a significant ($p \leq 0.05$) difference in the moisture content of street vendor sample when compared with control and value-added sample. However, a non-significant ($p \leq 0.05$) difference was there in the moisture content of control and value-added sample. Moisture content was maximum in the *Spring roll* collected from street vendor (10.28%) when compared with control (6.28%) and value added (5.87%) *Spring roll*. The colour of *Spring roll* procured from street vendor was light brown which clearly gives a clue about the less frying time of *Spring roll* collected from street vendor than the frying time of control and value-added *Spring roll*. Thus, there were less moisture loss in the street vendor samples of *Spring roll* than the control and value-added *Spring roll*.

The ash content of control, street vendor and value-added sample was 4.92, 5.12 and 4.13 per cent, respectively. There was a non-significant ($p \leq 0.05$) difference in the ash content of control, street vendor and value-added sample of *Spring roll* when compared with each other. The ash content was maximum in street vendor sample and was minimum in the value-added sample, which might have been due to difference in raw ingredients only.

Table 3 shows that the crude fibre content in control, street vendor and value-added sample of *Spring roll* was 1.06, 0.79 and 2.50 per cent, respectively. Difference in the crude fibre content of the value-added *Spring roll* was found significant ($p \leq 0.05$) when compared with control and street vendor. However, a non-significant ($p \leq 0.05$) difference was observed in the crude fibre content of the control and street vendor sample when compared with each other. Added of soya chunks and sprouts might have been given a significantly ($p \leq 0.05$) higher fibre content to the value-added *Spring roll* as compared to the control and street vendor samples.

The fat content of control, street vendor and value-added sample of spring roll was 13.34, 16.47 and 28.25 per cent, respectively. The fat content of value-added sample varied significantly ($p \leq 0.05$) from the fat content of control and street vendor sample when compared to each other. However, a non-significant ($p \leq 0.05$) difference was observed between the fat content of control and street vendor sample when compared with each other. Fat content was maximum in value added sample as compared to the control and street vendor sample. Value added Spring roll had high oil absorption capacity which might be one of the reasons of having high fat content in value added sample when compared with control and samples procured from street vendor.

As per the data depicted in table 3, there was 13.41, 13.19 and 20.41 per cent of protein in the control, street vendor and value-added samples of Spring roll. The difference in the protein content of value-added sample was significant ($p \leq 0.05$) when compared with control and street vendor sample. However, a non-significant ($p \leq 0.05$) difference was there in the protein content of control and street vendor sample. Protein content was maximum in the value-added Spring roll as compared to the rest of the sample. The high protein content in value added sample might have been due to the addition of soya chunks in the stuffing of the *Spring roll*.

The carbohydrate content of control, street vendor and value-added sample was 60.96, 50.92 and 38.78 per cent, respectively. The control, value added and the *Spring roll* procured from street vendor was found to have a significant ($p \leq 0.05$) difference in the carbohydrates content when compared with each other. However, the carbohydrate content was higher in the control sample as compared to street vendor and value-added *Spring roll*.

Nutritional Composition: The NPN content of control, street vendor and value-added sample of *Spring roll* was 0.53, 0.32 and 0.54 per cent respectively. A non-significant ($p \leq 0.05$) difference was observed in the NPN content of control, street vendor and value-added samples of *Spring roll* when compared with each other. NPN content was maximum in the value-added *Spring roll* followed by control and street vendor samples of *Spring roll*.

The true protein content in the control, street vendor and value-added sample was 12.88, 12.87 and 19.86 per cent, respectively. The difference in the true protein content of value-added sample was significant ($p \leq 0.05$) when compared with control and street vendor sample of *Spring roll*. However, the difference in the true protein content of control and value-added sample was non-significant ($p \leq 0.05$). True protein was maximum in the value-added *Spring roll* as compared to control and street vendor sample. The high protein content of value-added *Spring roll* than the control and street vendor sample might have been due to the replacement of noodle used as stuffing in the *Spring roll* with soya granules which might have been caused a hike in the protein content of value-added *Spring roll*.

The calorific value of control, street vendor and value-added sample of *Spring roll* was 417.6, 404.75 and 491.13 kcal, respectively. A significant ($p \leq 0.05$) difference was observed in the calorific value of value-added sample when compared with control and street vendor sample. However, the difference was non-significant ($p \leq 0.05$) in the calorific value of control and street vendor. Addition of healthy ingredients in the value-added *Spring roll* resulted a significant ($p \leq 0.05$) increase in the calorific content of value-added *Spring roll*. The energy content was maximum in the value-added sample than the controlled (417.60 kcal) and street vendor samples (404.75 kcal).

The starch content of control, street vendor and value-added sample was 43.93, 37.62 and 23.06 per cent respectively. The starch content of controlled sample, street vendor and value-added sample was found non-significant ($p \leq 0.05$) when compared with each other. The least content of starch in the value-added *Spring roll* might be due to replacement of refined flour which is used as parent ingredient for *Spring roll* covering with whole wheat flour, Bengal gram flour and rice flour in the ratio 3: 1: 1. The noodles used for stuffing of value-added *Spring roll* was also replaced with sprouts, green vegetables and soya granules which were found to have low starch content than the noodles.

The reducing sugar content of various samples of *Spring roll* was to be, 3.32, 1.60 and 4.64 per cent, respectively. There was a significant ($p \leq 0.05$) difference in the reducing sugar content of control, street vendor sample and value-added *Spring roll* when compared with each other. The content was maximum in the value-added sample followed by control and street vendor sample.

The non-reducing sugars of control, street vendor and value-added sample was 1.51, 5.99 and 7.18 per cent, respectively. From the depicted data it has been observed that the non-reducing sugar content in the control sample differed significantly ($p \leq 0.05$) from the street vendor and value-added sample, when compared with each other. However, the highest non-reducing sugar value was in value added *Spring roll*. Difference in the non-reducing sugar content of street vendor and value-added sample was non-significant ($p \leq 0.05$) when compared with each other.

The total sugar content of control, street vendor and value-added sample of *Spring roll* was 4.84, 7.60 and 11.82 per cent respectively. A significant ($p \leq 0.05$) difference was observed in the total sugar content of control, street vendor and value-added sample when compared with each other. Total sugar content was maximum in the value-added *Spring roll* whereas was minimum in the control sample of *Spring roll*.

There was 4.45, 8.95 and 2.92 per cent of ADF in the control, street vendor and value-added samples respectively. The ADF was non-significantly ($p \leq 0.05$) higher in the street vendor sample of *Spring roll* followed by control and value-added*Spring roll*. However, there was a significant ($p \leq 0.05$) difference in the ADF content of control, street vendor and value-added sample of *Spring roll*, when compared to each other.

The NDF content of control, street vendor and value-added sample of Spring roll was 20.70, 28.5 and 53.4 per cent respectively. The NDF content of value-added sample of *Spring roll* differed significantly ($p \leq 0.05$) from control and street vendor sample when compared with each other. However, a non-significant ($p \leq 0.05$) difference was there in the NDF content of control and street vendor sample. NDF was maximum in the value-added *Spring roll* as compared to the control and street vendor sample.

The hemicellulose found in control, street vendor and value-added *Spring roll* was 16.05, 25.75 and 47.25 per cent, respectively. The hemicellulose content of value-added sample of *Spring roll* differed significantly ($p \leq 0.05$) from control and street vendor sample when compared with each other. However, a non-significant ($p \leq 0.05$) difference was also noticed in the hemicellulose content of control and street vendor sample. Hemicellulose was maximum in value added *Spring roll* when compared with the control and street vendor samples of *Spring roll*.

Dietary fibre constituent like ADF, NDF and hemicellulose was maximum in the value-added sample of *Spring roll* which might have been due to addition of soya granules, sprouts, carrot, peas and sprouts in the spring roll stuffing and replacing the refined flour used for making *Spring roll* covering with whole wheat flour, gram flour and rice flour.

Peroxide value of control, street vendor and value-added samples was 3.01, 15.82 and 1.64 meq/kg respectively. Peroxide value of control, street vendor and value-added samples of *Spring roll* differed significantly ($p \leq 0.05$) when compared with each other. Peroxide value which is known to be an important parameter for estimation of rancidity was below the minimum risk limit among all the samples. However, the values were maximum in the samples of *Spring roll* procured from street vendors and minimum in the value-added sample.

FFA content in control, street vendor and value-added sample of *Spring roll* was 0.08, 1.07 and 0.07 per cent respectively. The FFA content of control, street vendor and value-added sample of *Spring roll* differed significantly ($p \leq 0.05$) when compared with each other. However, a non-significant ($p \leq 0.05$) difference was observed in the FFA content of control and value-added sample. Content was found minimum in the value-added sample and maximum in the samples procured from street vendor.

Antioxidant activity, DPPH content among various samples of Spring roll was 44.15, 53.47 and 56.33 per cent, respectively. There was a significant difference in the DPPH content of control sample, when compared with street vendor and value-added sample of *Spring roll*. However, the difference was non-significant in the DPPH content of street vendor and value-added sample. DPPH content was maximum in the value-added *Spring roll* and minimum in the street vendor samples.

Macro and Micro minerals: The iron content in control, street vendor and value-added sample of *Spring roll* was 4.00, 4.68 and 6.35mg/100g, respectively (Table 5). A significant ($p \leq 0.05$) difference in the iron content of control, street vendor and value-added sample of *Spring roll* was there when compared with each other. However, maximum amount of iron was in the value-added *Spring roll* and minimum in the control samples.

As per the data depicted in table 5, the amount of zinc present in the control, street vendor and value-added sample of *Spring roll* was 1.03, 1.33 and 3.29mg/100g respectively. A significant ($p \leq 0.05$) difference was there in the control, street vendor and value-added samples of *Spring roll* when compared with each other. Zinc content was also significantly ($p \leq 0.05$) higher in the value-added samples of *Spring roll* when compared with control and street vendor sample.

There was 39.07, 55.47 and 87.57mg/100g of calcium in the control, street vendor and value-added sample of *Spring roll*, respectively. The difference in the control, street vendor and value-added sample of *Spring roll* was significant ($p \leq 0.05$) when compared with each other. The amount of calcium was in value added sample of *Spring roll* and minimum in the control sample.

The phosphorus content in the control, street vendor and value-added sample was 78.41, 76.68and 133.99mg/100g respectively. The content was maximum in the value-added *Spring roll* followed by control and street vendor *Spring roll.*

Organoleptic Evaluation: According to the data given in figure 1, the color score for control, street vendor and value-added sample of *Spring roll* was 7.33, 7.51 and 7.51, respectively. A non-significant ($p \leq 0.05$) difference was there in the color score of control, street vendor and value-added sample when compared with each other.

The taste scores for control, street vendor and value-added samples was 6.82, 7.11 and 7.41, respectively. There was a non-significant ($p \leq 0.05$) difference in the taste scores of control, street vendor and value added samples of *Spring roll* when compared with each other. The maximum score for taste was in value added sample of *Spring roll* and minimum in the control sample.

The scores for flavour in control, street vendor and value-added sample of *Spring roll* was 6.48, 7.03 and 7.32, respectively. The score was non-significantly ($p \leq 0.05$) higher in the value-added *Spring roll* when compared with control and the samples procured from street vendor.

The texture scores for control, street vendor and value-added samples of *Spring roll* was 6.96, 7.15 and 7.61, respectively. A non-significant ($p \leq 0.05$) difference was noticed in the texture scores of control street vendor and value-added sample of *Spring roll* when compared with each other. The maximum scores were for value added Spring roll which might have been due to variation among the raw ingredients used.

The overall acceptability scores for control, street vendor and value-added samples of *Spring roll* were 6.91, 7.20 and 7.47 respectively. A significant ($p \leq 0.05$) difference was there in the texture scores of value-added samples when compared with street vendor and control sample of *Spring roll*. There was a non-significant ($p \leq 0.05$) difference in the overall acceptability scores of controls, and street vendor samples of *Spring roll*, when compared with each other.

Value added samples of *Spring roll* had highest scores for color, taste, texture, flavor and overall acceptability. This might have been due to alteration of *Spring roll* sheets with whole wheat flour, rice flour and gram flour which might have been made them crispier than the rest of samples. This also might be due to the modification of spring roll stuffing with soya granules and sprouts added a different taste and flavor in it.

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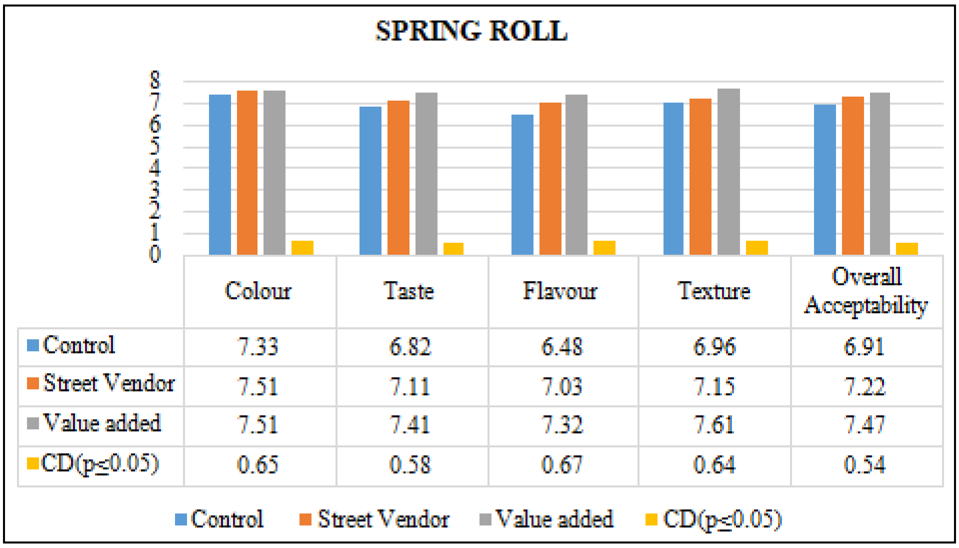

Figure 1: Organoleptic Evaluation of *Spring rolls*

Table 1: List of ingredients used for preparing *Spring roll*

Ingredients	Control	Value added
Refined flour	100g	-
Whole wheat flour+ gram flour+ rice flour	-	50 +25+25g
Soya granules	-	15g
Green gram sprouts	-	10g
Bengal gram sprouts, peas, carrot, green chillies	-	5g (each)
Salt	-	3g
Cabbage, carrot	10g (each)	40g (each)
Vinegar, soya sauce, red chilli and green chilli sauce	2ml (each)	1ml each
Noodles (boiled)	100g	-
Oil for frying	-	-

Table 2: Functional properties of *Spring rolls*

Parameters	Control	Street vendor	Value Added	CD (P≤0.05)
Water absorption capacity (ml/g)	2.23	2.89	2.33	0.57
Oil absorption capacity (ml/g)	0.26	0.98	2.03	0.88

Table 3: Proximate composition of *Spring roll*

Parameters	Control	Street vendor	Value Added	CD (P≤0.05)
Moisture (%)	6.28	10.28	5.87	1.16
Crude ash (%)	4.92	5.12	4.13	1.94
Crude Fibre (%)	1.06	0.79	2.50	0.37
Ether extract (%)	13.34	16.47	28.25	4.14
Crude Protein (%)	13.41	13.19	20.41	4.52
Total carbohydrates (%)	60.96	50.92	38.78	9.76

Table 4: Nutritional composition of *Spring rolls*

Parameters	Control	Street vendor	Value Added	CD (P≤0.05)
NPN (%)	0.08	0.51	0.08	NS
True Protein (%)	12.91	10.00	19.91	2.10
Energy (Kcal/100g)	417.6	404.75	491.13	2.65
Starch (%)	43.93	37.62	23.06	NS
Reducing sugars (%)	3.32	1.60	4.64	0.53
Non-reducing sugars (%)	1.51	5.99	7.18	2.60
Total sugars (%)	4.84	7.60	11.82	2.46
ADF (%)	4.45	8.95	2.92	1.56
NDF (%)	20.5	28.5	53.4	14.7
Hemi-cellulose (%)	16.05	25.75	47.25	15.26
Peroxide value (meq/kg)	3.01	15.82	1.64	0.59
FFA (% Oleic acid)	0.08	1.07	0.07	0.05
DPPH (% inhibition)	44.15	53.47	56.33	8.50

Table 5: Macro and micro mineral content of *Spring roll*

Parameters	Control	Street vendor	Value Added	CD (P≤0.05)
Iron (mg/100g)	4.00	4.68	6.35	0.63
Zinc (mg/100g)	1.03	1.33	3.29	0.02
Calcium (mg/100g)	39.07	55.47	87.57	12.59
Phosphorus (mg/100g)	78.41	76.68	133.99	12.59