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Development and Standardization of Vermicelli by Underutilized Millet (Sorghum)

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ABSTRACT

The sorghum is considered as millet which is an indispensible food for millions of people living in semi arid tropics. It is used as food for humans and accounts as a major source of calories and vital component for food security in semi arid regions of the developing world. The present study focused on the use of sorghum for the production of extruded products like vermicelli. The techniques used for the processing are sorting, cleaning, drying, milling in rawa for the development of vermicelli. Physical properties like bulk density, water activity, water absorption, cooking time, cooking weight were done and nutritional properties like moisture, protein, fiber, amylase, alcohol acidity were analyzed. Further , the sorghum and wheat semolina of particle size 0.1 mm were kept in the extrudate for mixing by pouring Luke warm water at 40 ^{0} C for 30 minutes and with 5 different variations (SW:T1-50:50,SW:T2-60:40,SW:T3-70:30,SW:T4-80:20,SW:T5-100) was subjected to extrusion cooking at 55 ^{0} C using single screw cold extruder (La Monfernina, Italy) at 80 rpm was dried at ambient temperature for 6 hrs before packing hence, gave good appearance and was compared with the commercial one. The vermicelli extruded from pure sorghum semolina was served as control. The organoleptic qualities of the extruded samples were analyzed by semi trained panel members on a structured 5 point hedonic scale. The findings of the present study revealed significant differences ($p<0.05$) in all the parameters. The result obtained sowed higher preference for the variation (SW: T1-50:50). It was finally concluded that the sorghum vermicelli prepared using single screw extruder is highly acceptable when compared with others.

Key words: *Sorghum, Moisture, Protein, Fiber, Amylase, Alcohol acidity*

INTRODUCTION

Extruded products are ready to cook products which usually include vermicelli. The product is made with sorghum semolina. There are two types of extruders they are: cold extruder and hot extruder. Hot extruder is more popular, used for making snacks (Ready to eat products) like kurkure. At the same time ready to cook products are also becoming popular in urban areas which requires less time of cooking. To manufacture vermicelli, cold extruder machine can be used, this process, in turn could speed up the sorghum vermicelli production, easy to handle and sanitize.

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Extrusion cooking is a continuous process which has high production capacity, versatility, and low cost per product unit. The sorghum vermicelli was judged for their uniformity and cooking quality. Plasticity of dried vermicelli, lower cooking loss, shape retention and cooking loss, shape retention and non-stickiness when cooked are some of the desirable properties of sorghum vermicelli. In the standardization process of sorghum vermicelli the ingredients used were a mixture of sorghum semolina and wheat semolina were passed through 200 mesh sieve (BSS) for ensuring uniform mixing and held in the single screw extruder(La Monfernina, Italy) by pouring luke warm water at 40 C for 30 minutes at a temperature of 55 C. Thus, now it was sent into the extrudate for obtaining desired product. Hence, the study conducted was based on the standardization of sorghum vermicelli, effect of extruded factors, proximate composition and sensory attributes were studied.

MATERIAL AND METHODS

Sorghum grain was procured from Directorate of Sorghum Research processing unit and subjected for primary processing like sorting, cleaning, drying, milling and finally processed into sorghum semolina using secondary processing (Brabendar Unit), wheat semolina was procured from local market. Both the samples were passed through 200 mesh sieve (BSS).

Physico-chemical characteristics:

Proximate composition of the samples i.e; moisture, ash, fat, protein, amylase, alcoholic acidity, fiber and physical properties like Bulk density, water activity, water absorption, cooking time, cooking weight, drying time, sensory evaluation were determined using standard procedures.

Formulation of sorghum vermicelli:

For the formulation of blends already procured materials were used. Along with sorghum semolina, wheat semolina was blended at levels of 50%, 40%, 30% and 20%. The blends were mixed well and sieved through a 200 mesh sieve (BSS) for uniform mixing.

Properties of vermicelli:

Sorghum semolina and wheat semolina was used to make vermicelli of (sieve 200 microns BSS) semolina was allowed to mix for 30 minutes by pouring luke warm water at 40 C, the temperature of the single screw extruder(La Monfernina, Italy)was maintained at 55 C by water cooling. The product was then fed into the extrudate and extruded according to the shape required. Similar procedure was followed for all the variations. After extrusion the samples were subjected to drying at 60 C in tray drier for 6 hours before packing.

Sensory evaluation:

The sorghum vermicelli was prepared into a recipe according to the standard procedure and subjected to sensory evaluation of all the (SW:T1-50:50,SW:T2-60:40,SW:T3-70:30,SW:T4-80:20,SW:T5-100) variations. Sensory evaluation was an important part of the process of estimation of nutrient composition in foods, like wise it was necessary in the study of processing and storage effects. The products acceptability can be evaluated through the standard sensory evaluation technique by the selected group of panel members. The quality parameter such as color, texture, taste, appearance, firmness, bulkiness, non-stickiness and overall acceptability was carried out by panel of judges on 5 point hedonic scale.

Statistical analysis:

All the parameters in extrusion processing were carried out in replicates. The data was analyzed using mean, standard mean and analysis of variance (ANNOVA).

RESULTS AND DISCUSSION

Physic-chemical properties of sorghum vermicelli:

The nutrient profile and physic chemical characteristics of (SW:T1-50:50,SW:T2-60:40,SW:T3-70:30,SW:T4-80:20,SW:T5-100) variations are given in the table:1. Among the 5 blends the moisture and ash contents of T3 and T4 were higher than T1 and T2 .where as the protein content , dietary fiber, fat content were higher in SW:T1-50:50

than others and similar trend was observed for Amylase. SW:T1-50:50 has higher Bulk density value than others, where as . SW:T1-50:50 exhibited higher water activity and water absorption capacity. The reason could be due to high amounts of protein and dietary fiber in the sample SW:T1-50:50.

Samples	SW:T1-50:50	SW:T2-60:40	SW:T3-70:30	SW:T4-80:20	SW:T5-100
Moisture	9.0 ± 0.44	9.44 ± 0.40	10.06 ± 0.22	9.81 ± 0.04	12.44 ± 0.01
Protein	9.8 ± 0.21	9.7 ± 0.14	9.6 ± 0.28	9.5 ± 0.14	9.5 ± 0.14
Fat	0.45 ± 0.07	0.46 ± 0.06	0.53 ± 0.11	0.68 ± 0.04	0.86 ± 0.01
Fiber	0.80 ± 0.02	0.77 ± 0.007	0.77 ± 0.02	0.74 ± 0.02	1.25 ± 0.21
Amylose	13.98 ± 2.19	15.33 ± 1.96	16.59 ± 1.13	17.01 ± 1.01	18.48 ± 0.01
Alcohol acidity	0.09 ± 0.01	0.09 ± 0.01	0.09 ± 0.01	0.08 ± 0.007	0.09 ± 0.01
Water activity	0.56 ± 0.006	0.66 ± 0.002	0.66 ± 0.002	0.68 ± 0.004	0.68 ± 0.004
Bulk density	0.44 ± 0.01	0.42 ± 0.005	0.41 ± 0.005	0.36 ± 0.005	0.35 ± 0.005
carbohydrates	74.8 ± 0.14	72.2 ± 0.22	76.1 ± 0.007	74.3 ± 0.41	72.6 ± 0.01
Energy	173.5 ± 0.7	208.5 ±0.7	243.1±1.6	278.1 ±1.5	348.5 ±0.7

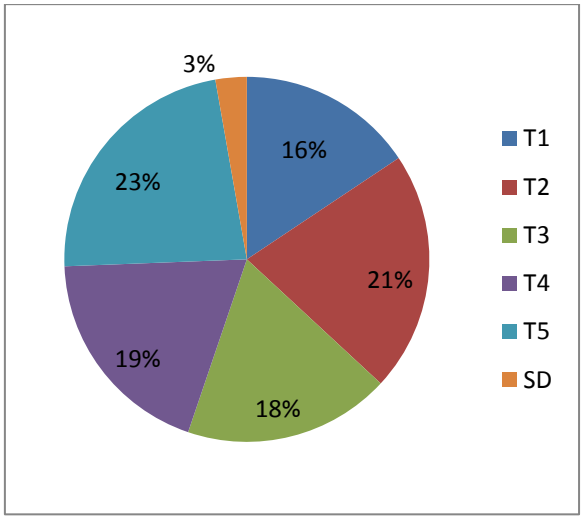
Drying time:

The low moisture content of sorghum vermicelli about (8.37%) resulted in short drying time hence saving the time as shown in table: 2.

Drying time	Temperature	T1	T2	T3	T4	T5
10 min	40 C	10.28±0.1	10.34±0.01	10.10±0.02	9.9±0.03	9.86±0.01
20 min	50 C	19.61±0.02	9.40±0.01	9.35±0.03	9.09±0.02	9.21±0.02
30 min	60 C	8.65±0.01	8.37±0.01	8.37±0.05	8.11±0.02	8.67±0.02

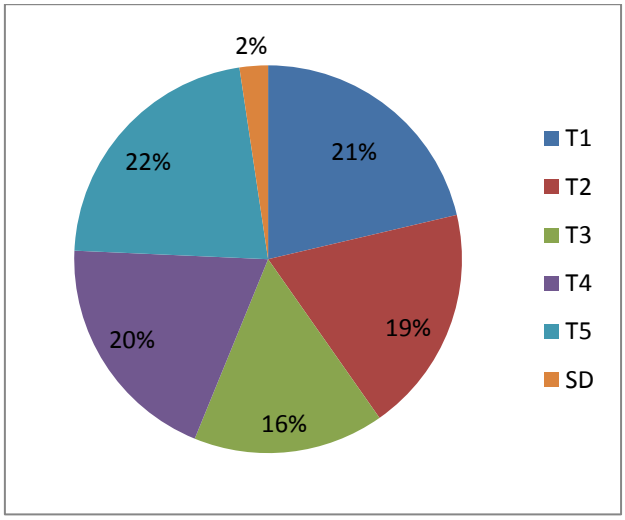
Cooking time:

Cooking time and cooking weight was determined following AACC (10). Five grams of (5 cm long) of sorghum vermicelli were placed in 300 ml of boiling water in a 500 ml beaker. The vermicelli strands were removed at regular intervals of time and pressed between two glass plates. The time required for the opaque part in the strand to be gelatinized was considered as cooking time.



Cooking weight:

Cooking weight(% dry basis), as a measure of the degree of hydration, a sample of 25gm dry vermicelli was cooked in 300 ml boiling water and optimal cooking time, was recorded. These analyses were done in replicates. The cooking weights of different blends are given in replicates.



Effect of extrusion on cooking quality of extruded sorghum vermicelli

Samples	Cooking time	Cooking weight
SW:T1-50:50	7.12±0.01	56.0±0.01
SW:T2-60:40	7.35±0.01	58.0±0.01
SW:T3-70:30	8.01±0.01	59.0±0.01
SW:T4-80:20	7.58±0.03	54.0±0.01
SW:T5-100	7.16±0.02	58.0±0.01

Sensory evaluation:

Samples	Color	Appearance	Taste	Texture	Firmness	Bulkiness	Non-stickiness	Overall acceptability
SW:T1-50:50	4.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
SW:T2-60:40	5.0	5.0	5.0	4.0	4.0	4.0	5.0	5.0
SW:T3-70:30	4.0	3.0	4.0	5.0	4.0	4.0	3.0	4.0
SW:T4-80:20	4.0	4.0	3.0	3.0	3.0	3.0	3.0	4.0
SW:T5-100	5.0	5.0	5.	5.0	5.0	4.0	5.0	5.0

CONCLUSION

From the above study it may be concluded that the sample SW:T1-50:50 can be used as a source of high fiber and nutrients such as proteins and vitamins. The physic chemical characteristics exhibited by SW:T1-50:50 would be desirable in the production of sorghum vermicelli without effecting the composition of nutrients, with good anti oxidant activity which also improves the shelf life of the product, this detailed parametric study have shown that the color of vermicelli is slightly changed by extrusion processing like temperature of extrusion is the main factor responsible for the degradation of the cooking quality. The control of the temperature during the vermicelli extrusion seems to be the simplest method to guarantee a satisfactory finished product. Hence the standardization of the sorghum vermicelli was done using single screw extruder.

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