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Development of Wafers Incorporated with Pearl Millet Flour & Barnyard Millet Flour

V. Sruthi[1], Prof. Dr. Kavita Waghray[2], Ankush Narayan Rathod[3]

[1]Post Graduate Student ,Food Technology,University College of Technology (A) Osmania University, Hyderabad, Telangana, India

[2]Professor ,Food Technology, University College of Technology (A) Osmania University, Hyderabad, Telangana, India

[3]Quality Executive, Kamala Consumer Care Pvt LTD, Kothur, Rangareddi, Telangana, India

ABSTRACT

Wafers incorporated with pearl millet flour and barnyard millet flour were developed and assessed for their nutritional & sensory parameters. Total eight formulations were prepared. A control was prepared with refined wheat flour and remaining all ingredients are same for all proportions. The highest value of Protein content was observed for the formulation with 30 % refined wheat flour,70 % pearl millet flour(C) and Fat, Carbohydrates is highest in the formulation with 50% refined wheat flour,30 % pearl millet flour + 20 % barnyard millet(H).Highest value of ash content was observed for the formulation with 50 % refined wheat flour,50%barnyard millet flour(E).Highest value of crude fiber observed for the formulation 30% refined wheat flour,70% barnyard millet flour. Sensory scores were highest for the formulation with 50 %refined wheat flour,50 % pearl millet flour making it the most acceptable formulation. Nutritionally and organoleptically (Taste) the above stated formulations were superior but their visual appearance was negatively affected due to increased Color compared to the control.

Keywords: Refined Wheat Flour, Wafers, Pearl millet Flour, Barnyard millet flour

I. INTRODUCTION

The term 'wafer' usually refers to a thin crisp type of biscuit.The principal ingredient of wafers is wheat flour and the products undergo a process of heat treatment which reduces the moisture content of the products to a low level. Wafers and Wafer products are generally regarded by the consumer as biscuits and they are frequently manufactured and sold by biscuit companies. Wafers consist essentially of a dried, highly aerated starch gel in which the starch granules have been completely gelatinized and dispersed. Wafers offer a unique sensorial experience to consumers. Driven by consumer trends towardsproducts which are lighter but still indulgent, the wafer category is expected to grow further. Wafersare seldom eaten alone and are often combined with components with a contrasting texture, such as chocolate or ice cream. Wafers are intermediate components used in the manufacture of several top selling confectionery products. The crispness and lightness contrasts well with soft cream or chocolate. The level of crispness and its retention over shelf life are critical parameters for the quality of wafer based confectionery products.

Millets are nutritionally rich and occupy an important place in the diet of people in many regions of the world. Although millets are nutritionally superior to cereals their utilization as a food is still mostly confined to the traditional consumers and population of lower economic strata.(R.V. Jaybhaye,.L.

Pardeshi)Millets are considered as crop of food security because of their sustainability in adverse agro-climatic conditions (Ushakumari *et al.*, 2004). These crops have substantive potential in broadening the genetic diversity in the food basket and ensuring improved food and nutrition security (Mal *et al.*, 2010). Along with nutrition millets offer health benefits in daily diet and help in the management of disorders like diabetes mellitus, obesity, hyperlipidemia, etc. (Veena, 2003).

Pearl Millet (Pennisetumglaucum): Pearl millet also known as bajara is one of the important millet grown in tropical and semi-arid region of the world. The amino acid composition has significant effect on the nutritional quality of protein. It has high energy, less starch, low GI and is gluten free. Pearl millet with regard to nutritional quality is equivalent to maize and generally superior to sorghum in protein content/quality and metabolizable energy levels (Agteet al., 1999), as well as digestibility (Ejeta et al., 1987). Tannins commonly found in other staple crops such as sorghum, which can decrease digestibility (Dykes and Rooney, 2006) usually absent which contain significant amounts of condensed polyphenols. Pearl millet is also rich in important micronutrients such as Fe and Zn, and has a more complete amino acid profile than maize or sorghum (Ejeta et al., 1987). Taken in totality, these qualities make pearl millet a major contributor of dietary protein, Fe, and Zn intake in a variety of rural populations in India (Kodkanyet al., 2013).

Barnyard millet (Echonochloa frumentacaea): Barnyard millet called by several other names viz., *Japanese* barnyard millet, *ooda, oodalu, sawan, sanwa*and *sanwank.*Nutritionally too, it is a good source of protein, which is highly digestible and is an excellent source of dietary fibre with good amount of soluble and insoluble fractions. The carbohydrate content ofbarnyard millet is low and slowly digestible, which makes the barnyard millet a nature's gift for the modern mankind who is engaged in sedentary activities. In barnyard millet the major fatty acid is linoleic acid followed by palmitic and oleic acid. It also shows a high degree of retrogradation of amylase, which facilitates the formation of higher amounts of resistant starches. Hence it can be potentially recommended for the patients with cardiovascular disease and diabetes mellitus. Barnyard millet is most effective in reducing blood glucose and lipid levels.

II. MATERIALS & METHODS

2.1 Materials:

- Refined Wheat flour (Maida)
- ,Pearl millet flour
- Barnyard millet flour
- Lecithin
- Palm oil
- Salt

which were procured from the local market

2.2 Method of Processing Wafers

2.2.1 Mixing Of Batter:Mixing of all the raw materials together for 2.5–6 minutes to achieve homogeneity. Usage of high shear mixers is best suited for the purpose because slower mixers may allow gluten strand formation. This results into strings and lumps in the mixed batter. The mixing process should proceed as soon as possible after the assembly of all the ingredients. This reduces the possibility of a 'dough' formation between flour and water. The use of cold water also reduces the tendency for gluten string formation. Immediately after mixing, the batter has much air incorporated and may be slightly lumpy due to incomplete mixing. As the air rises out of the mix the viscosity reduces. A screen helps in removal of lumps and gluten strands and a constant gentle agitation to prevent separation in the batter.

2.2.2 Baking: The baking process involves the usage of Wafer Ovens. Ovens are made up of heated metal plates hinged at one side, typically thin and usually

bear intricate surface patterns. The plate pairs either attached to heavy carriers or are self-supporting linked together to form a chain. Heating of plates is done through direct impingement of gas flames or individually by electric heaters arranged in the backs of each plate. Almost 20 pair plates may form a single plant. The batter is deposited, usually in lines, across the lower plate, and on closing and locking with the upper plate. The very rapid production of steam not only spreads the batter evenly throughout the gap between the plates but also to a certain extent out through the vents. A minimum extrusion through all the vents is the aim as because that portion is valueless. The thickness of the wafers is proportional to the gap between the two plates.

2.2.3 Cooling: Convection air cooling at 10-12ºC. The humidity of the air should be kept as low as possible because by cooling the RH rises and this promotes moisture pick-up by the exposed wafers. The cooled wafer books should not leave the cooler with a surface temperature below the local dew point otherwise moisture will be picked up on the exposed wafers and warping leading to splitting apart of wafers from cream may occur.

2.2.4 Cutting: The cooled books are cut into eating size squares, rectangles, fingers, etc. This is done by pushing them singly or in small piles through sets of taut wires, blades or circular saws

2.3 Processing of development of wafers with pearl millet flour and Barnyard millet flour

Table 2.1 Wafers developed with various proportions of Pearl millet flour and barnyard millet flour.

Sample	Maida(%)	Pearlmillet flour (%)	Barnyard millet flour (%)
Control (T)	100	-	-
A	70	30	-
B	50	50	-
C	30	70	-
D	70	-	30
E	50	-	50
F	30	-	70
Mixed Sample –G	70	20	10
Mixed Sample-H	50	30	20

T: Control; A: 70% Refined wheat flour +30 % Pearl millet flour; B: 50 % Refined wheat flour+50% Pearl millet flour; C: 30 % Refined wheat flour +70% Pearl millet flour;D:70% Refined wheat flour+30% Barnyard millet flour; E: 50 % Refined wheat flour+50% Barnyard millet flour;F:30% Refined wheat flour+70% Barnyard millet flour; G:70% Refined wheat flour+20%Pearl millet flour+10%Barnyard millet flour;H:50% Refined wheat flour+30%Peral millet flour+20% Barnyard millet flour.

III. RESULTS AND DISCUSSION

The results obtained from the work on development of wafers supplemented with pearl millet flour and barnyard millet flour in different ratios are presented in this chapter. The results of this study are tabulated and discussed keeping in view the various objectives of the study

3.1 Proximate analysis of various wafers formulations

The results obtained after the proximate analysis of various wafers formulations is compiled in table 3.1

Table 3.1. Proximate Analysis of constituents for various wafers formulations

Samples	Moisture%	Fat %	Protein %	Ash %	CHO %	Crude fiber %
Control-T	1.5	5.2	8.3	0.5	72	4.1
A	1.27	3.9	11.2	0.81	64.9	1.9
B	0.93	4.4	11.6	0.9	65.2	2.0
C	0.58	4.8	11.82	0.93	66.8	2.2
D	1.34	4.1	5.9	1.2	64.2	10.9
E	1.29	4.62	6.0	1.32	64.7	11.5
F	1.16	4.8	6.4	1..6	65.1	12.8
Mixed Sample-G	1.12	5.1	9.3	1.1	68.6	9.4
Mixed Sample-H	1.36	5.3	9.1	1.24	69.2	9.6

T: Control; A: 70% Refined wheat flour +30 % Pearl millet flour; B: 50 % Refined wheat flour+50% Pearl millet flour; C: 30 % Refined wheat flour +70% Pearl millet flour;D:70% Refined wheat flour+30% Barnyard millet flour; E: 50 % Refined wheat flour+50 % Barnyard millet flour;F:30% Refined wheat flour+70% Barnyard millet flour; G:70% Refined wheat flour+20%Pearl millet flour+10% Barnyard millet flour;H:50% Refined wheat flour+30%Peral millet flour+20% Barnyard millet flour.

3.1.1 Moisture Content : Even though Wafers from all the formulations were subjected to a constant drying time of 4.5 hr in hot air oven there was very slight difference in the moisture contents of the formulations .It could be due to the difference in the quantity of water used for batter making which again is influenced by increasing proportions of pearl millet flour and barnyard millet flour. Moisture Content was highest in sample H (50% Refined wheat flour+30%Peral millet flour+20% Barnyard millet flour).

3.1.2Protein Content: The protein content is contributed by wheat flour, millets. The protein content was highest (11.82 %) in sample C due to increased pearl millet flour.

3.1.3Carbohydates: The carbohydrate content was found to be the highest (69.2 %) in formulation H. It could be due to the increased content of the pearl millet flour and barnyard millet flourin formulation (H) as both millets are rich in carbohydrates.

3.1.4Fat Content: The fat content was highest (5.3%) in sample H (50% Refined wheat flour+30%Peral millet flour+20% Barnyard millet flour).

3.1.5Ash Content: The mineral content was found to be highest (1.6 %) in sample F followed by sample E. It could be due to increased percentage of Barnyard millet.

3.1.6 Crude Fiber: Fiber content increased in all the supplemented samples compared to control (T) due to

barnyard flour and pearl millet flour. Crude fiber content is highest (5.6 %) in the formulation C with 40 % pearl millet flour + 30 % barnyard millet followed by formulation B with30 % pearl millet flour + 20 % barnyard millet.

3.2Microbial analysis of various wafers formulations

3.2.1.Fungal Count Test :There were more cfu's in the samples B,C,D & H (40 cfu/gm) due to increased nutrient content in terms of carbohydrates, proteins, vitamins and minerals in the formulations due to increased levels of Pearl millet flour and Barnyard millet flour.

3.2.2 Bacterial Count Test: The tests were conducted for dry wafer The cfu/gm considerably increased due to increased nutrient composition in the supplemented formulations due to increasedbarnyard flour and pearl millet flour.

3.3 Sensory Characteristics of wafers incorporated with pearl millet flour and barnyard millet flour

The eight formulations were subjected to sensory evaluation. The sensory scores suggested that B (30 % pearl millet flour + 20 % barnyard millet) had maximum acceptability

Table 3.2 Sensory score of incorporated formulations

Samples	Mean Value of sensory score					
	Color	Appearance	Taste	Texture	Flavour	Overall acceptability
T	7.5±0.9944	7.8±0.7888	6.5±0.5163	7±0.6234	7.1±0.2881	7.3±0.6992
A	7.2±1.1737	7.5±1.0234	7.9±0.7563	6.5±0.5923	6.9±1.0342	7.1±0.2791
B	6.9±0.5612	7.2±1.8932	7.3±0.5201	6.2±0.9745	6.8±0.8284	7.8±0.4931
C	6.5±0.1452	6.3±1.5621	6.6±0.4389	6±0.2745	7.5±0.5813	6.9±0.9014
D	6.4±1.32645	6.2±0.5378	6.9±0.2916	7.1±0.6513	6.3±0.6941	6.8±0.5391
E	6.1±0.6759	6.5±0.9012	6.5±0.4247	6.4±0.9503	6.2±1.0472	6.5±0.6582
F	6.2±1.4619	6.0±1.7432	6.3±0.5370	6.8±0.7247	6.7±0.6193	6.1±0.3812
G	7.7±0.5678	7.3±1.6723	7.1±0.2764	7.9±0.5932	7.1±0.8209	7.4±0.9413
H	6.9±0.5163	6.6±0.9376	6.8±0.9520	6.5±0.3974	6.3±0.9125	6.6±0.7321

IV. CONCLUSION

As a conclusion, the highest value of Protein content was observed for the formulation with 30 % refined wheat flour,70 % pearl millet flour(C) and Fat, Carbohydrates is highest in the formulation with 50% refined wheat flour,30 % pearl millet flour + 20 % barnyard millet(H).Highest value of ash content was observed for the formulation with 50 % refined wheat flour,50%barnyard millet flour(E).Highest value of crude fiber observed for the formulation 30% refined wheat flour,70% barnyard millet flour. Sensory scores

were highest for the formulation with 50 %refined wheat flour,50 % pearl millet flour making it the most acceptable formulation. Nutritionally and organoleptically (Taste) the above stated formulations were superior but their visual appearance was negatively affected due to increased Color compared to the control.

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