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RESEARCH ARTICLE

Standardization and Evaluation of Physical, Textural and Organoleptic Properties of Chicken Biscuits

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Abstract

Biscuits are convenient and inexpensive food products that are becoming very popular in India. The present study was conducted to standardize and evaluate the physical, textural and organoleptic properties of chicken biscuits by using defatted chicken, maida flour, spices, butter and baking agents. Control was prepared without adding chicken. Chicken biscuits were prepared by adding 5%, 10%, 15%, 20% and 25% of defatted chicken into flour with other ingredients. The physical, textural and organoleptic properties of the chicken biscuits were carried out. The results of Hunter's Lab colour analysis showed that addition of chicken in the biscuits at 5–25% levels resulted in increase of the whiteness, and decrease in yellowness whereas control biscuits had high in redness. The texture analysis showed that breaking strength decreased with incorporation of chicken at 5% to 20% level. Nine-point hedonic scale ranking method was used to evaluate the organoleptic characteristics of prepared biscuits. The 5% defatted chicken added biscuits were well accepted by sensory panelist. Thus it can be concluded that biscuits can be made with substitution of defatted chicken up to 5 % without adversely affecting the sensory characteristic of biscuit.

Introduction

In developing countries like India with the increasing urbanization, the demand of processed food is also increasing rapidly. Among the processed foods, bakery products, particularly biscuits command wide popularity in rural as well as urban areas among all the age groups. Breads and biscuits are major products accounting for 80% of the total bakery products in India (Agarwal, 1990). Biscuits possess several attractive features including wider consumption, low cost among other processed foods, varied taste, easy availability and good eating quality and relatively long shelf-life (Gandhi et al., 2001; Ayo and Olawale, 2003). Biscuit along with bread form major baked food accounting for over 30 and 50% of total bakery products respectively, produced in India (Shukla et al., 2000).In biscuit making, the principal ingredients are wheat flour, sugar, fat, water and salt. These are mixed together with other minor ingredients (baking powder, skimmed milk, emulsifier and sodium meta bisulphite) to form dough containing well developed gluten network. The nature and quantity of ingredients are used to determine the quality of the biscuit. Several researchers have described the effect of major ingredients in biscuit dough systems and on the final product (Maache-Rezzoug et al., 1998; Chevallier et al., 2000a; Chevallier et al., 2000b). Biscuits are high in carbohydrates, fat and calorie but low in fiber, vitamin, and mineral which make it unhealthy for daily use. Because of its acceptability in all age group, longer shelf life, better taste and its position as snacks it is considered as a good product for protein fortification and other nutritional improvement (Serrem et al., 2011).

Meat and meat products are essential components in the diets of developed countries. They are important sources of proteins, vitamins and minerals (Jimenez-Colmenero, 2001). The demand for processed meat product is increasing continuously with growing consumer's response and awareness about the nutrition and quality. Poultry meat is comparatively more acceptable than other meat because of its

flavour, ease of digestion, low fat content, and high ratio of unsaturated fatty acids and also due to excellent source of protein (Narayankhedkar, 2004). Poultry meat consumption has been increasing at a rapid rate over the past 50 years in places such as North America and elsewhere. The rapid increase in poultry meat consumption has been due to factors such as healthy image, price, availability and development of new products. The poultry industry has also focused on delivering various new products and/or adopting some traditional red meat products (e.g. chicken, turkey and ham) (Barbut, 2012).The use of chicken which is a good source of protein, vitamins and minerals to the wheat flour shows promise in improving the nutritive value of the final product, since the available literature on incorporation of chicken in biscuits is scanty. Therefore, this study was designed for preparation and standardization of biscuits incorporated with chicken.

Material and Methods

Raw materials

Maida flour, Fresh Chicken, Butter, Salt, Sugar, Coriander Powder, Pepper, Cardamom, Cinnamon, Cloves and Ginger Powder were procured from the local market of Pondicherry, India.

Development of Chicken biscuits

Spices are added for flavour, fragrance, preservative as well as color and inherent medicinal qualities. Ratio of spices mixture for the biscuit formulation was standardized, which was shown in the Table -1.

Table1. Composition of Spices Mixture

Name of the Spice	Quantity (g/100g)
Coriander	33.30
Cardamom	8.40
Cinnamon	8.40
Cloves	3.36
Chilli powder	33.60
Ginger powder	8.40
Pepper	4.25

The basic formulations used for preparation of biscuits from six different treated samples were outlined in Table- 2. Chicken biscuits were developed according to the method of Sinha and Kulkarni (1991) with slight modification. All the ingredients were weighed accurately according to the formulation. Chicken was deboned. Defatting of the chicken was done by Elinsky (1989). The defatted chicken of different concentration 0% (T_1), 5%(T_2), 10%(T_3), 15%(T_4), 20%(T_5), and 25%(T_6), was taken and minced along with the other ingredients in a Mincer for 5 min at 125 rpm to obtain a homogeneous mixture. Its forms emulsified dough. The dough rolled into uniform sheet of desired thickness and was cut with the help of properly shaped cutter. These biscuits were put in the tray on butter paper and baked in baking oven at 150°C for 4min (Banureka and Mahendran, 2009). Baked biscuits were finally cooled and assessed for physical and organoleptic characteristics.

Table2. Basic formulation of ingredients for each treatment.

Ingredients (g)	**Treatments**					
	T_1	**T_2**	**T_3**	**T_4**	**T_5**	**T_6**
Maida flour	100	95	90	85	80	75
Butter	30	30	30	30	30	30
Chicken	**0**	**5**	**10**	**15**	**20**	**25**
Sugar	10	10	10	10	10	10
Salt	3	3	3	3	3	3
Spices Mixture	6	6	6	6	6	6
Baking Powder	0.5	0.5	0.5	0.5	0.5	0.5

Physical properties of chicken biscuits

Weight, Density, Diameter and Thickness of biscuits were calculated by AACC (1969) method.

Colour of chicken biscuits

The colour of the biscuit was measured using a Hunter's Lab colour analyzer (Hunter lab scan XE, Reston VA, USA). In the Hunter's lab colorimeter, the colour of a sample is denoted by the three dimensions, L*, a* and b*. The L*, a* and b* readings were then recorded in the software provided in a attached computer. The L* value gives a measure of the lightness of the product colour from 100 for perfect white to 0 for black, as the eye would evaluate it. The redness/greenness and yellowness/ blueness are denoted by the a* and b* values, respectively. The colour of the samples was measured after putting the samples in front of smallest aperture (Navneet and Shitij, 2011).

Textural profile analysis of chicken biscuits

Hardness of the chicken biscuits was determined by texture analyzer (Stable Micro Systems Ltd., TA HD plus (5197) UK) equipped with a 500 kg load cell.

Breaking strength of biscuit was measured using the HDP/BS blade. The individual samples of biscuits were placed on the platform such that they were supported at two points and the blade was attached to the cross head of the instrument. The TA setting was kept at: pre-test speed of 2mm/s, test speed of 3mm/s; post-test speed of 10mm/s. This test simulates the evaluation of hardness by consumer holding the biscuit in hands and breaking the same by bending. The absolute peak force from the resulting curve was considered the breaking strength of the biscuit (Singh et al., 1993; Bourne, 2002).

Organoleptic Evaluation

Biscuits were evaluated organoleptically for different quality attributes and overall acceptability. Sensory evaluation was performed using a panel consisting 20 trained panellist using 9-point Hedonic scale as per the method described by Meilgaard et al. (2007). The mean of sensory scores for attributes viz. appearance, colour, taste, texture and overall acceptability were recorded. Three replications of each sample were used for statistical analysis. Data was subjected to Analysis of Variance (ANOVA) using MS Excel 2007, and the means were compared by Critical Difference (CD). Differences at $P<0.05$ were considered to be significant.

Result and Discussion

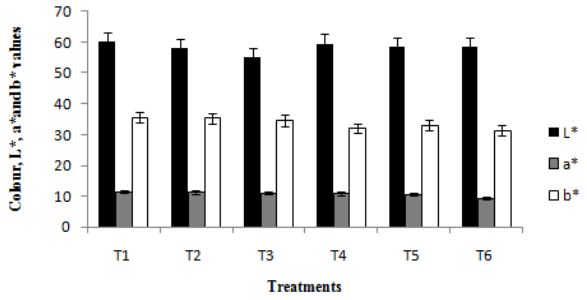
The effect of level of incorporation of chicken on physical properties of biscuit such as weight, diameter, thickness and density were studied and given in Table 3. It was observed that with increasing level of chicken to maida flour, density and thickness has been increased. Density was increased from 0.81(g/cm3) for 5% to 0.89(g/cm3) for 25% incorporation of chicken. Whereas diameter was decreased for 5%, 10%, 15% and 20% incorporation of chicken. This is in agreement with the findings of Abd El-Hady (2012) and Kumar et al. (2010). But diameter was increased at 25% incorporation. On the other hand the result shows that control treatment T1 has the maximum thickness 5.23 followed by the T6 (5.20), T5 (5.18), T4 (5.17), T3 (5.17) & T2 (5.15). Biscuit thickness increases from 5.15(mm) to 5.20(mm) with increasing level of substitution (Table 3). The results obtained were agreed with the previous results (Sharif et al., 2009; Tiwari et al., 2011; Mishra and Chandra, 2012).

Table3. Physical properties of chicken biscuits.

Parameters	Treatments					
	T_1	T_2	T_3	T_4	T_5	T_6
Weight (g)	8.09	8.09	8.10	8.10	8.11	8.17
Diameter (mm)	36.10	36.00	35.70	35.67	35.77	36.00
Thickness (mm)	5.23	5.15	5.17	5.17	5.18	5.20
Density (g/cm3)	0.81	0.81	0.84	0.84	0.85	0.89

Colour differences including visual brightness (L), redness to greenness (a), yellowness to blueness (b) of soy fortified millet biscuits were measured by Colour Hunter Lab. L* value is a measure of the lightness–darkness fraction (L* =0 yields black and L* =100 indicates white) (Mamat et al., 2010). The inclusion of the chicken in the biscuits at 5–25% levels resulted in increase of the whiteness, and decrease in yellowness. Similar change in L* and b* values were reported earlier (Kumar et al., 2010, Navneet and Kshitij, 2011; Singh et al., 2008) Since L* value was reducing, signifying that the colour becomes darker as the chicken level increased in the biscuits, which may be due to comparatively darker colour of the chicken. a* value gives an indication of the redness and high a* values were found for control followed by the 5% chicken incorporated biscuits.

Figure1. Variation of colour (L*, a* and b* values) with different treatments of chicken biscuits.



Texture is a very important quality characteristic which makes a significant contribution to the overall quality acceptance of food products. It was one of the three main acceptability factors used by consumers to evaluate food, the other two being appearance and flavour (Bourne, 1990). The breaking strength is also one of the criteria to measure the biscuit hardness and the results for this parameter are summarized in Table4. The maximum breaking strength decreased from control sample with incorporation of chicken at 5% to 20% level. Breaking strength was 5.54 Kg for control sample and decreased to 4.22, 3.38, 3.08, 2.57 and 1.98 for 5%, 10%, 15%, 20% and 25%

incorporation respectively. The texture of baked biscuits is primarily attributable to starch gelatinization and super cooled sugar rather than a protein/starch structure (Gallagher, 2002). This may be the reason for decrease in hardness of the biscuits with increase in chicken incorporation.

Table4. Texture Profile Analysis for chicken biscuits

Treatments	Breaking strength (Kg)
T_1	5.54
T_2	4.22
T_3	3.38
T_4	3.05
T_5	2.57
T_6	1.98

Sensory analysis was carried out by using 20 experienced panellists to measure sensory characteristics like senses of appearance, taste, texture and colour acceptability of product. Mean score for sensory evaluation of biscuit given in Table 5.

It revealed that there was a significant difference ($P \leq 0.05$) between treatments for sensory attributes. The 5% incorporated chicken biscuits were rated highest for the external appearance and biscuit containing 20% chicken was rated poorest in terms of appearance. Taste is the primary factor which determines the acceptability of any product, which has the highest impact as far as market success of product, is concerned. The score for taste had also been decreased from 7.36 to 6.09 with the increase in the level of substitution of chicken. The 5% chicken added biscuits has the highest mean value (7.36) and 25% chicken added biscuit has the least mean value (6.09) for taste. The score for the texture of the biscuits were highest for 10% incorporation followed by control and 5% incorporated biscuits. The 25% chicken added biscuit had the least mean value for texture. Sensory rating of biscuit for color shows that T2 (7.72) has ranked at top due to excellent colour followed by control treatment T1 (7.27), T3 (7.54), T6 (7.14) and T4 (6.63) while minimum colour acceptance was observed in T5 (6.45). Overall acceptability includes many implications, which is the important parameter in organoleptic estimation. At 5% level of chicken incorporation, biscuits had higher scores for all the sensory attributes evaluated. Above this level other biscuits received lower sensoryscores.

Table 5. Organoleptic evaluation of biscuits incorporated with different levels of chicken.

Treatments	Appearance	Taste	Texture	Color	Over all Acceptability
T_1	7.35 ± 0.06^{a}	7.00 ± 0.15^{b}	7.45 ± 0.27^{a}	7.27 ± 0.19^{a}	7.38 ± 0.28^{a}
T_2	7.40 ± 0.15^{a}	7.36 ± 0.11^{a}	7.27 ± 0.03^{b}	7.72 ± 0.18^{c}	7.80 ± 0.18^{b}
T_3	6.54 ± 0.03^{c}	7.27 ± 0.12^{a}	7.60 ± 0.10^{a}	7.54 ± 0.15^{d}	7.72 ± 0.22^{b}
T_4	6.23 ± 0.04^{d}	6.90 ± 0.04^{c}	5.81 ± 0.05^{c}	6.63 ± 0.21^{b}	5.59 ± 0.12^{c}
T_5	6.00 ± 0.04^{e}	6.42 ± 0.06^{d}	6.81 ± 0.17^{d}	6.45 ± 0.18^{b}	6.86 ± 0.17^{d}
T_6	7.35 ± 0.06^{a}	6.09 ± 0.08^{e}	6.36 ± 0.16^{e}	7.14 ± 0.28^{a}	6.72 ± 0.15^{d}

Means values followed by the same letters within the column were not significantly different ($P < 0.05$)

Conclusion

The present research was conducted to standardise the biscuits, enriched with defatted chicken. The physical, textural characteristics revealed that biscuits containing 5% defatted chicken were the best among all biscuits. The finding of this research revealed that biscuit can be made with substitution of chicken up to 5 % without adversely affecting the sensory characteristic of biscuit. Hence chicken can be used in biscuit formulation which is widely accepted bakery product in India.

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References

AACC. 1969. Approved Methods of the American Association of cereal chemistry. 7th edition. St Paul, MN: American Association of Cereal Chemists.

Abd El-hadv, S.R. (2012): Utilization of defatted wheat germ flour as nutrient supplement of biscuits. J. Agric. Research., 1: 238-253.

Agarwal, S.R. (1990): Prospects for small-scale biscuit industry in the nineties. Indian Food Industry., 9:19-21.

Ayo, J.A., and Olawale, O. (2003): Effect of defatted groundnut concentrate on the physicochemical and sensory quality of "fura". Nutrition Food Sci., 4: 175-183.

Banureka, V.D., and Mahendran, T. (2009): Formulation of Wheat - Soybean biscuits and their quality characteristics. Tropical Agric. Res. Extension., 2: 62-66.

Barbut, S. (2012): Convenience breaded poultry meat products - New developments. Trends Food Sci. Technol., 26:14-20.

Bourne, M. (2002): Food texture and viscosity: Concept and measurement. Food science and technology.International series.2nd Edition. Academic Press, pp: 353–368.

Bourne, M. C. (1990): Basic Principles of Food Texture Measurement. In: faridi, H ., and Faubion, J.M. (eds), Dough Rheology and Baked Product Texture New York : AVI Van Nostrand Reinhold. Pp. 331.

Chevallier, S., Colonna, P., Buleon, A. and Dellavalle, G. (2000a): Physicochemical behaviours of sugars, lipids, and gluten in short dough and biscuit. J. Agric. Food Chem., 48: 1322–1326.

Chevallier, S., Colonna, P. A., Dellavalle, G. and Lourdin, D. (2000b): Contribution of Major ingredients during baking of biscuit dough systems. J. Cereal Sci., 3: 241–252.

Elinsky, S.E. (1989): Process for defatting meats. United States patent 4,847,099.

Gallagher, E. (2002): The application of functional ingredients in short dough biscuits. MSc thesis. Department of Food Technology. University College of Cork. Cork, Ireland.

Gandhi, A.P., Kotwaliwale, N., Kawalkar, J., Srivastava, D.C., Parihar, V.S. and Raghu Nadh, P. (2001): Effect of incorporation of defatted soy flour on the quality of sweet biscuits. J. Food Sci. Technol., 38:502–503.

Garcia, M.L., Dominguez, R., Galvez, M.D., Casas, C. and Selgas, M.D. (2002): Utilization of cereal and fruit fibers in low fat dry fermented sausages. Meat Science., 60: 227–236.

Jimenez-Colmenero, F., Carballo, J. and Cofrades, S. (2010): Healthier meat and meat products: their role as functional foods. Meat Science., 59: 5–13.

Kumar, S., Rekha. and Sinha, L.K. (2010): Evaluation of quality characteristics of soy based millet biscuit. Adv. Appl. Sci. Res., 3: 187-196.

Maache-Rezzoug, Z., Bouvier, J.M., Karim, A. and Patras, C. (1998): Effect of principal ingredients on rheological behaviour of biscuit dough and on quality of biscuits. J. Food Eng., 35:23–42.

Mamat, H., Abu Hardan, M.O. and Hill, S.E. (2010): Physicochemical properties of commercial semi-sweet biscuit. Food Chem., 121:1029–1038.

Mattes, R. D. (1998): Position of the American Dietetic Association: fat replacers. J. Am. Dietetic Assoc., 98:463–468.

Meilgaard, M.C., Civille, G.V. and Carr, B. T. (2007): Sensory Evaluation Techniques. New York: C.R.C. Press L.L.C.

Mishra N., and Chandra, R. (2012): Development of functional biscuit from soy flour & rice bran. Int. J. Agric. Food Sci., 1:14-20.

Navneet, K., and Shitij. K. (2011): Development of carrot pomace and wheat flour based cookies. Pure Appl. Sci. Technol., 1: 4-10.

Serrem, C., Kock, H. and Taylor, J. (2011): Nutritional quality, sensory quality and consumer acceptability of sorghum and bread wheat biscuits fortified with defatted soy flour. Int. J. Food Sci. Technol., 46: 74-83.

Sharif, M.K., Butt, M. S., Anjum, M . and Nawaz, H. (2009): Preparation of fiber and mineral enriched defatted rice bran supplemented cookies. Pakistan J. Nutrition., 5: 571-577.

Shukla, F.C., Shilpa, M . and Thind, S.S. (2000): Bakery industry in India present quality control and future scenario–A review. Beverage Food World., 27:11–15.

Singh B., Bajaj, M., Kaur, A., Sharma, S. and Sidhu, J.S. (1993): Studies on the development of high protein in biscuits from composite flours. Plant Foods Human Nutrition., 43:181–189.

Singh, S., Riar, C. S. and Saxena, D.C. (2008): Effect of incorporating sweet potato flour to wheat flour on the quality characteristics of cookies. Afr. J. Food Sci. 2: 65-72.

Sinha L.K. and Kulkarn, S. D. (1991): Nutritional Characteristics of High Protein Soy Biscuits. Proc.9th. IFCOST. Mysore.

Tiwari B.K., Brennan, C.S., Jaganmohan, R., Surabi, A. and Alagusundaram, K. (2011): Utilisation of pigeon pea (*Cajanuscajan* L) by products in biscuit manufacture. LWT Food Sci. Technol., 44:1533-1537.