RESEARCH PAPER — FOOD SCIENCE RESEARCH JOURNAL
ISSN-0976-1276 ■ Visit us : *www.researchjournal.co.in*
Volume 11 | Issue 2 | October, 2020 | 151-157
DOI : 10.15740/HAS/FSRJ/11.1/151-157

Studies on textural and sensory quality attributes of biscuits using wheat, sorghum and groundnut blend flour

Rohit Kumar Maurya, Devendra Kumar, Devendra Singh and Vipin Kumar Verma

Experiments were conducted to evaluate quality attributes of biscuits using wheat, sorghum and groundnut blend flour. Study was also conducted to see the effect of blend flours treatments on textural characteristic and sensory evaluation. Flours blend were prepared with various combination of wheat, sorghum and groundnut as W_{80}: S_{15}: G_{05} (T_1), W_{70}: S_{20}: G_{10} (T_2) and W_{60}: S_{25}: G_{15} (T_3). Textural characteristics *viz.,* fracturability, hardness, cohesiveness, adhesiveness through texture analyzer. The sensory characteristics *viz*., colour, odor, flavour, taste, texture and overall acceptability were evaluated for fresh, 30, 60 and 90 days of storage period. The maximum hardness was found in sample prepared for treatment T_2 (2752.70 g), whereas higher cohesiveness value was obtained in sample of treatment T_1 (1.67). The adhesiveness and springiness were obtained maximum in sample of treatment T_3 (8.47 g.s) and treatment T_2 (2.09 mm), respectively. The gumminess and chewiness value were found highest in sample of treatment T_2 (4349.26 g) and treatment T_2 (9056.48 g.mm), respectively. Sensory characteristics as colour, odor, flavour, taste and overall acceptability were scored highest rating in T_2 treatment as compared to T_1 and T_3 treatments. Sensory score was decreased with increase of storage period in all treatments. Fresh biscuit samples prepared with wheat 70% + sorghum 20% + groundnut 10% rated highest score (7.8) than other treatments. The treatment (T_2) gave better product in view of colour, odor, flavour, taste and overall acceptability as well as textural quality attributes.

Key Words : Biscuit, Blend flour, Textural, Sensory

How to cite this article : Maurya, Rohit Kumar, Kumar, Devendra, Singh, Devendra and Verma, Vipin Kumar (2020). Studies on textural and sensory quality attributes of biscuits using wheat, sorghum and groundnut blend flour. *Food Sci. Res. J.,* **11**(2): 151-157, **DOI : 10.15740/HAS/FSRJ/11.2/151-157**.

INTRODUCTION

Biscuits are prepared for gaining the nutrients and energy as to complete a daily requirement in a short time. Biscuits are feasible to provide complete enrichment. Biscuits contain a potential enrichment as they are in different forms and flavour, have pleasant aroma and taste, and it can be consumed as snacks or integrant to other foods (Manley, 2005). The increasing awareness about the health benefits of natural dietary constituents has led to develop nutrition related products. The food industry is facing the challenge of developing new food products with special health enhancing characteristics. Due to increase in necessity of nutrition and mineral value in the food products, so there are many institutes and research centre are working on it as experimental bases and

MEMBERS OF RESEARCH FORUM

Author for correspondence :
Rohit Kumar Maurya, Dr. Bhim Rao Ambedkar College of Agricultural Engineering and Technology (C.S.A.U.A. and T.), **Etawah (U.P.) India**
Email: rohitmaurya3131@gmail.com

Associate Authors' :
Devendra Kumar, Devendra Singh and Vipin Kumar Verma, Dr. Bhim Rao Ambedkar College of Agricultural Engineering and Technology (C.S.A.U.A. and T.), **Etawah (U.P.) India**
Email:devendrachaturvedi2008@gmail.com; dsinghcsau@gmail.com; vipincaet79@gmail.com

practical bases. Sources of these materials come from a wide variety of plant consumable products. In last decade, biscuits consumption had increased as a snack because due to having a various type of flavour, taste, texture, colour and useful nutrients. Biscuits contain different amount of protein, fat, mineral, carbohydrate and calorific energy. Mainly commercial biscuits also contain low nutrients value. Cereals contain a sufficient amount of protein, vitamin, carbohydrate, fibre and minerals. Gani *et al*. (2015) reported that biscuits contain low amount of protein content around (7–10%). Biscuits may be classified either by the degree of enrichment and processing or by the method adopted in shaping them. word biscuit originated in France and its meaning "twice baked" and become better for conservation (Manley, 2005). Gandhi *et al.* (2001) reported that biscuits are widely popular in rural and urban region due to having a low cost along with pleasant taste, aroma and long shelf-life. Biscuits may be prepared by different types of flour. Enriched nutritional biscuits be prepared by using blend of wheat, sorghum and groundnut flour.

Wheat is a widely cultivated in worldwide and it is staple food (Shewry, 2009). Wheat is an important source of carbohydrates. Wheat is a source of multiple nutrients and dietary fibre. Gluten is the major part of wheat protein. Noorfarahzilah *et al.* (2014) discussed about the blend of wheat flour with different sources of cereal, legumes and fruits flour in different percentage to produce various food product. The blend of wheat flour with various sources of cereals, legumes and fruits flour, which make as multigrain food product and it contain better nutrition value. Otles and Caginidi (2006) discussed that there are many multigrain food products are acquirable in the market and attracting more consumers. Sorghum is important food and fodder cereal crops. Its scientific name *Sorghum bicolor* (USDA retrieved 2, 2016) and also called great millet. Sorghum is the 5th most important cereal crop in the world. Gluten-free food product can be made by sorghum and it substitute wheat (Lim, 2013). Sorghum contains 10.62g protein, 3.46g fat, 1.43g ash, 6.7g fibre, 72.09g carbohydrate and 329 kcal energy per 100g edible portion (USDA Food Data Central-2019). Groundnut also known as peanuts (*Arachis hypogaea*) and it is the family of legumes, stated by (Bonku and Yu, 2019). Groundnut contains as nutrients such as protein, oils, fibre, vitamins and carbohydrate as compared to other types of nuts (Arya *et al.,* 2015). It is an especially good source of nutrients with a sufficient amount of protein, lipid and fibre. They also contain plenty of potassium, phosphorous, magnesium, carbohydrate, vitamins and minerals. Protein content 20.7-25.3 per cent, crude fat 31-46 per cent, ash content 1.2-2.3 per cent, crude fibre 1.4-3.9 per cent, carbohydrate 21-37 per cent and moisture content 4.9-6.8 per cent all nutrient constituents of peanuts (Alhassan *et al.,* 2017). Biscuits were prepared by using wheat, sorghum and groundnut blend flour. Tang *et al*. (1995) studied the effect of pH on the properties of gels prepared with whey protein connected by compression in an instran and evaluated hardness, cohesiveness and springiness from double compression curve. Ahmed *et al.* (2005) evaluated textural analyses of papaya and tomato fruits bar. Texture study revealed that hydrocolloids incorporation at 1 per cent each of starch + ethyl cellulose and pectin of starch, 1.5 per cent each caused significant ($P<0.5$) increased in compactness and hardness of texture. Muntoz *et al*. (2007) evaluated the sensory- texture attributes of firmness, elasticity and type of breakdown of gelatin. Estimates of sensory firmness by shearing were highly correlated with each other and with mechanical shear and compression forces. Patil *et al.* (2017) evaluated the textural and sensory quality of date mango leather. The sensory level ranked the best product at 1 per cent level of protein and carboxyl methyl cellulose with respect to colour, flavour, texture and overall acceptability. The results revealed that hardness and gumminess increased with addition of hydrocolloids. Galla *et al.* (2017) prepared biscuits using 5 per cent, 10 per cent and 15 per cent spinach powder and evaluated for their nutritional, textural, sensory and sorption behavior. Texture quality revealed that hardness and braking strength increased with increased addition of spinach powder. Sensory studies of biscuits showed that 5 per cent supplementation of spinach powder was more acceptable. Mounika and Srinivas (2018) developed biscuits in corporate with carrot powder to enhance the nutritional value. The portion of refined wheat flour and carrot powder were 97:3, 94:6, 91:9 and with these flour blends and used for making biscuit samples were 0,3, 6 and 9 per cent, respectably. Score for appearance, taste and colour was found highest in 0th day with a score of 7.6, 7.4 and 7.3 as compared to other biscuit samples. Therefore, the study was undertaken to evaluate textural and sensory quality attributes of biscuits using wheat, sorghum and groundnut blend flour.

METHODOLOGY

The study was undertaken to develop biscuits using the blend of wheat, sorghum and wheat flour and its qualitative analysis was done during various storage period at room temperature (around 30ºC) and relative humidity 70 per cent - 80 per cent. Flours blend were prepared with various combination of wheat, sorghum and groundnut. Based on the nutritional analysis of freshly made biscuits, the most preferred treatment were selected as T_1- W_{80}: S_{15}: G_{05}, T_2- W_{70}: S_{20}: G_{10}, T_3- W_{60}: S_{25}: G_{15}.

For development of biscuits, firstly measured all ingredients accurately. As per the process of making biscuits, initially mixed ingredients (milk, *Ghee*, sugar and baking powder) to make soft paste by rough rubbing for at-least 15 minutes. After that mixed a flour one by one on soft paste of ingredients and kneaded materials properly for 15-20 minutes. Once kneading completed, then it rolled, smooth and flat liked as chapati. Cut biscuit pieces as a desired shape and kept in aluminum tray. Now it ready to baked biscuits, so biscuit pieces kept along with aluminum tray in baking oven machine, when temperature of inside oven at +17ºC, with a proper precaution keep the tray in baking oven machine and closed for 13 to 15 minutes, until biscuits become golden brown colour. Taken out from machine and kept it for cooling at-least 30 minutes. After-that cooled biscuits were packed in polythene coated aluminum film. Biscuit packets were stored at a room temperature for further experimentation.

Textural characteristics *viz.*, fracturability, hardness, cohesiveness, adhesiveness, springiness, gumminess and chewiness were measured as per Bourne (1978) by Texture Analyser (TA-XT Plus). It was used to know the textural characteristics of sample of treatments (T_1, T_2, T_3). It was performed as the sample put on concentric base which was placed under a cylinder probe P/10 of having 10 mm diameter. As performing the test, the probe penetrated the sample until its breaks completely and then back to its initial position. At once a complete cycle performed, force – time graphs were obtained on data acquisition software (texture expert exceed ^{tm}). From these curves, measured various textural characteristics of sample of treatments (T_1, T_2, T_3).

Sensory quality attributes such as colour, odor, flavour, taste, texture and overall acceptability of the product of biscuit was evaluated as recommended by Ranganna, 2001. Hedonic rating test method was used for the evaluation. This test measures the consumer acceptability. Under the methodology, A panel consisting of members of different age groups having different eating habits was constituted to evaluate the quality through properly-planned experiment. Samples were served to the panelist and they were asked to rate the acceptability of the product through the sense of organs. Different attributes such as colour, odor, flavour, texture, taste and overall acceptability were rated on the basis of hedonic scale, ranging from 1 (extremely dislike/most undesirable) to 9 (extremely like/most desirable).

OBSERVATIONS AND ASSESSMENT

The study was undertaken to develop biscuits using the blend of wheat, sorghum and wheat flour and its qualitative analysis was done during various storage period at room temperature. Texture profile curves were generated by texture analyzer (TA-XT-plus) for measuring various textural characteristics of biscuit sample of treatment (T_1, T_2, T_3). The textural attributes *viz.*, fracturability, hardness, cohesiveness, adhesiveness, springiness, gumminess and chewiness were evaluated by analysis of texture profile curves of biscuit samples (Table 1 and 2). The fracturability is not shown in any texture profile curves of biscuits samples. Hardness was highest (2752.70 g) for biscuit sample using composition of blend flour T_2 (W_{70}: S_{20}: G_{10}) and least hardness (2022.90 g) for biscuit sample using composition of blend flour T_1 (W_{80}: S_{15}: G_{05}). Cohesiveness was highest (1.67) for biscuit sample using composition of blend flour T_1 (W_{80}: S_{15}: G_{05}). The cohesiveness of biscuit samples range between 1.67 to 0.80. Adhesiveness was highest (8.47 g.s) for biscuit sample using composition of blend flour T_3 (W_{60}: S_{25}: G_{15}) and least adhesiveness (4.71 g.s) for biscuit sample using composition of blend flour T_2 (W_{70}: S_{20}: G_{10}). Springiness was highest (2.09 mm) for biscuit sample using composition of blend flour T_2 (W_{70}: S_{20}: G_{10}) and least springiness (1.60 mm) for biscuit sample using composition of blend flour T_3 (W_{60}: S_{25}: G_{15}). Szczesniak (1975) stated that gumminess is the energy required to disintegrate a semisolid food products to a states ready for swallowing and is related to the primary parameters of hardness and cohesiveness and the chewiness is the energy required to masticate a solid food product to state ready for swallowing and it is related to the primary parameters of hardness, cohesiveness and

elasticity. Gumminess and chewiness were reported highest (4349.26 g) and (9089.95 g.mm) for biscuit sample using composition of blend flour T_2 (W_{70}: S_{20}: G_{10}), respectively whereas lowest value shown for gumminess (1756.60 g) and chewiness (2810.59 g.mm) for biscuit sample using composition of blend flour T_3 (W_{60}: S_{25}: G_{15}), respectively.

Sensory analysis of biscuits just after preparation and after 30, 60 and 90 days of storage period were evaluated on a 9 point scale by hedonic rating test method. Score evaluated by the panelist to the individual sensory characteristics namely colour, odor, flavour, taste, texture and over acceptability of biscuits made from blend of different composition of wheat, sorghum and groundnut blend flour, are presented in Table 3 to 6. The results revealed that treatments have significant ($p< 0.05$) effect on sensory characteristics. Sensory score decreased rapidly during increase of storage period in fresh as well as in 30, 60 and 90 days storage of samples. Changed in characteristics of biscuits may be due to non-enzymatic browning reaction (millard reaction) and auto-oxidation (Thavani *et al.,* 2016). In general, score awarded to individual sensory characteristics in which overall scores of fresh biscuit samples rated highest score (7.8) in T_2 (W_{70}: S_{20}: G_{10}) and lowest score (7.2) in T_3 (W_{60}: S_{25}: G_{15}) as shown in Table 3. The sensory score ranged between 7 to 8 ("like moderately to like very much"). Representation of sensory characteristics for fresh samples given in Fig. 1. Sensory characteristics of biscuit

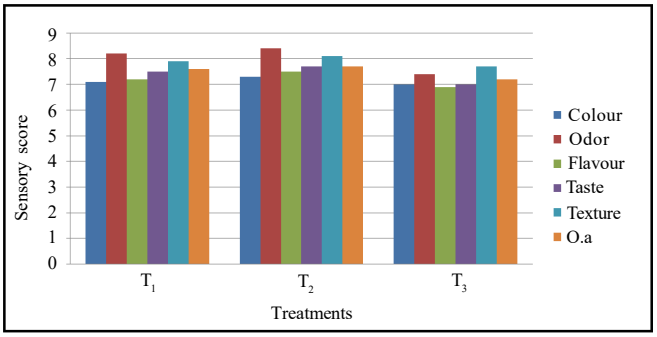

Fig. 1 : Effect of different blend flour biscuits on sensory characteristics of fresh biscuits (0 day)

Table 1: Texture analysis of biscuit using different treatments

Blend flour treatments	Force for first significant break (g)	The peak force (g)	Area of first bite cycle (g.s)	Area of second bite cycle (g.s)	First negative force area (g.s)	Time elapsed (s)
T_1	-	2022.90	873.89	1463.27	7.64	0.88
T_2	-	2752.70	1101.89	1746.23	4.71	1.10
T_3	-	2189.90	1089.19	873.68	1.72	1.64

T_1 - 80% wheat flour + 15% sorghum flour + 05% groundnut flour, respectively.
T_2 - 70% wheat flour + 20% sorghum flour + 10% groundnut flour, respectively.
T_3 - 60% wheat flour + 25% sorghum flour + 15% groundnut flour, respectively.

Table 2 : Textural attributes of biscuit using different treatments

Blend flour treatments	Fractur-ability (g)	Hardness (g)	Cohesiveness	Adhesiveness (g.s)	Springiness (mm)	Gumminess (g)	Chewiness (g.mm)
T_1	-	2022.90	1.67	7.64	2.0	3378.24	6756.48
T_2	-	2752.70	1.58	4.71	2.09	4349.26	9089.95
T_3	-	2189.90	0.80	8.47	1.60	1756.60	2810.59

T_1 - 80% wheat flour + 15% sorghum flour + 05% groundnut flour, respectively.
T_2 - 70% wheat flour + 20% sorghum flour + 10% groundnut flour, respectively.
T_3 - 60% wheat flour + 25% sorghum flour + 15% groundnut flour, respectively.

Table 3: Effect of different blend flour biscuits on sensory characteristics of fresh biscuits (0 day)

Characteristics	T_1	T_2	T_3
Colour	7.1	7.3	7.0
Odor	8.2	8.4	7.4
Flavour	7.2	7.5	6.9
Taste	7.5	7.7	7.0
Texture	7.9	8.1	7.7
Overall acceptability	7.5	7.8	7.2

samples stored for period of 30 days observed highest score (8.1) for odor in T_2 (W_{70}: S_{20}: G_{10}) and lowest score (6.5) for flavour in T_3 (W_{60}: S_{25}: G_{15}), whereas overall acceptability rated score 7.4, 7.6 and 6.9 for the sample of treatment T_1, T_2 and T_3, respectively as shown in Table 4. The bar chart representation (Fig. 2) shown various sensory characteristics of biscuit samples after 30 days storage period. Sensory score of samples after storage of 60 days is tabulated in Table 5. Highest score was rated for colour 7.1 (T_2), odor 7.8 (T_2), flavour 7.1 (T_2), taste 7.2 (T_2), texture 7.6 (T_2) and overall acceptability 7.3 (T_2). Graphical representation of sensory characteristics of samples given in Fig. 3 after 60 days storage. Sensory characteristics of samples after storage

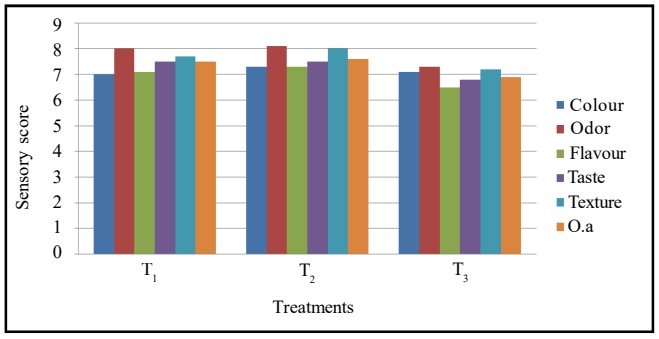

Fig. 2 : Effect of different blend flour biscuits on sensory characteristics of biscuits (30 days)

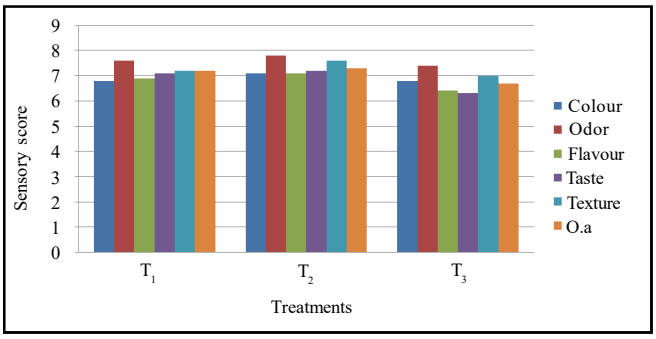

Fig. 3 : Effect of different blend flour biscuits on sensory characteristics of biscuits (60 days)

Table 4: Effect of different blend flour biscuits on sensory characteristics of biscuits (30 days)

Characteristics	T_1	T_2	T_3
Colour	7.0	7.3	7.1
Odor	8.0	8.1	7.3
Flavour	7.1	7.3	6.5
Taste	7.5	7.5	6.8
Texture	7.7	8.0	7.2
Overall acceptability	7.4	7.6	6.9

Table 5: Effect of different blend flour biscuits on sensory characteristics of biscuits (60 days)

Characteristics	T_1	T_2	T_3
Colour	6.8	7.1	6.8
Odor	7.6	7.8	7.4
Flavour	6.9	7.1	6.4
Taste	7.1	7.2	6.3
Texture	7.2	7.6	7.0
Overall acceptability	7.1	7.3	6.7

Table 6: Effect of different blend flour biscuits on sensory characteristics of biscuits (90 days)

Characteristics	T_1	T_2	T_3
Colour	6.5	6.7	6.1
Odor	7.1	6.9	5.8
Flavour	6.6	7.0	6.0
Taste	5.9	6.4	5.7
Texture	6.5	6.8	6.1
Overall acceptability	6.5	6.7	5.9

of 90 days rated lowest values than storage of fresh, 30 days and 60 days. The overall acceptability ranged between 5.9 to 6.7 as shown in Table 6 and graphical representation is given in Fig. 4. The biscuit samples of treatment T_2 (W_{70}: S_{20}: G_{10}) performed better results in view of sensory and textural attributes.

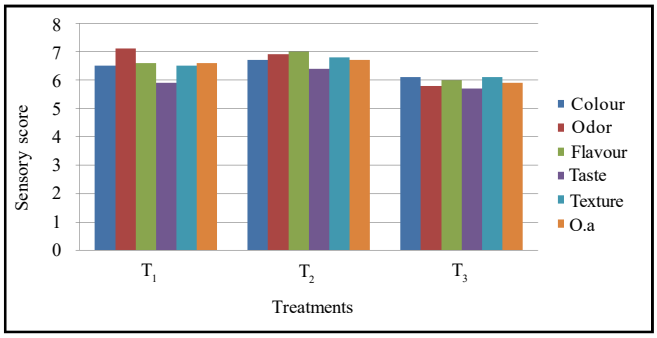

Fig. 4 : Effect of different blend flour biscuits on sensory characteristics of biscuits (90 days)

Conclusion:

Experiments were conducted to evaluate textural and sensory quality attributes of biscuits using wheat, sorghum and groundnut blend flour. On the basis of investigation, it is concluded that, flours blend prepared with combination of wheat, sorghum and groundnut as 70% wheat flour + 20% sorghum flour + 10% groundnut flour (T_2) rated highest score (7.8) than other treatments. Hardness was highest (2752.70 g) in T_2 (W_{70}: S_{20}: G_{10}) and least hardness (2022.90 g) in T_1 (W_{80}: S_{15}: G_{05}). Cohesiveness was highest (1.67) in T_1 (W_{80}: S_{15}: G_{05}). The cohesiveness of biscuit samples range between 1.67 to 0.80. Adhesiveness was highest (8.47 g.s) in T_3 (W_{60}: S_{25}: G_{15}) and least adhesiveness (4.71 g.s) in T_2 (W_{70}: S_{20}: G_{10}). Springiness was highest (2.09 mm) in T_2 (W_{70}: S_{20}: G_{10}) and least springiness (1.60 mm) in T_3 (W_{60}: S_{25}: G_{15}). Gumminess and chewiness was highest (4349.26 g) and (9089.95 g.mm) in T_2 (W_{70}: S_{20}: G_{10}), respectively and least gumminess (1756.60 g) and chewiness (2810.59 g.mm) in T_3 (W_{60}: S_{25}: G_{15}), treatment, respectively.

Overall scores of fresh biscuit samples rated highest score (7.8) in T_1 (W_{80}: S_{15}: G_{05}) and lowest score (7.2) in T_3 (W_{60}: S_{25}: G_{15}). Sensory characteristics of biscuit samples stored for period of 30 days observed highest score (8.1) for odor in T_2 (W_{70}: S_{20}: G_{10}) and lowest score (6.5) for flavour in T_3 (W_{60}: S_{25}: G_{15}), whereas overall acceptability rated score 7.5, 7.6 and 6.9 for the sample of treatment T_1, T_2 and T_3, respectively. Sensory score of samples after storage of 60 days was rated highest score for colour, odor, flavour, taste, texture and overall acceptability as 7.1, 7.8, 7.1, 7.2, 7.6 and 7.3, respectively. Sensory characteristics of samples after storage of 90 days rated lowest values than storage of fresh, 30 days and 60 days. The overall acceptability ranged between 5.9 to 6.7 for samples of T_2 treatments. The fresh biscuit prepared with blend flour as wheat flour 70 per cent, sorghum flour 20 per cent and groundnut flour 10 per cent accepted as best product in view of sensory and textural quality attributes.

Literature Cited

Ahmad, S., Varhney, A. K. and Srivastava, P.K. (2005). Quality attributes of fruit bar made from papaya and tomato by incorporation hydrocolloids. *Internet. J. Food Properties,* **8** (1) : 85-99.

Alhassan, K., Agbenorhevi, J.K. and Asibuo, J.Y. (2017). Proximate composition and functional properties of some new groundnut accessions. *J. Food Secur.,* **5** : 9-12.

Arya, S.S., Salve, S., A. R. and Chauhan, C. (2015). Peanuts as functional food: A review, *J. Food Science Technol.,* **53** : 31-41.

Bonku, R. and Yu, J. (2019). Health aspects of peanuts as an outcome of its chemical composition. *Food Science & Human Wellness,* **9** : 21-30.

Bourne, M. C. (1978).Texture profile analysis. *Food Technol.*, **32** (7) :62-66.

Galla, N.R., Pamidighantam , P.R., Karakala, B., Gurusiddaiah, M.R. and Satyanarayana, A. (2017). Nutritional, textural and sensory quality of biscuits supplimented with spinach. *Internat. J. Gastronomy & Food Science,***7**:20-26.

Gandhi, A.P., Kotwaliwale, N., Kawalkar, J., Srivastava, D.C., Parihar, V.S. and Raghu Nath, P. (2001). Effect of incorporation of defatted soy flour on the quality of sweet biscuits. *J. Food Science & Technol.*, **38** : 1423-1426.

Gani, A., Broadway, A.A., Ahmad, M., Ashwar, B.A., Wani, A.A., Wani, S.M., Masoodi, F.A. and Khatkar, B.S. (2015). Effect of whey and casein protein hydrolysates on rheological, textural and sensory properties of cookies. *J. Food Sci. Technol.,* **52** (9) : 5718-5726.

Lim, T.K. (2013). *Edible medicinal and non-medicinal plants*. **5**. Springer; Dordrecht, The Netherlands: pp. 359-384.

Manley, D. (2005). *Technology of biscuits, crackers and cookies,* Woodhead Publishing in Food Science and

Technology; Cambridge, United Kingdom, pp. 499.

Mounika, G. and Srinivas, M. (2018). Devlopment and sensory evaluation of biscuits by incorporation of carrot powder. *Internat. J. Current Microbiology & Applied Sciences*. **7** (4) : 2583-2592.

Muntoz, A. M., Pangborn, R. M. and Noble, A. C. (2007). Sensory and mechanical attributes of gal textural II, *J. Texture Studies,* **17**(1) : 217-236.

Noorfarahzilah, M., Lee, J.S., Sharifudin, M.S., Mohd Fadzelly, A.B. and Hasmadi, M. (2014). Application of composite flour in development of food products. *Int. Food Res. J.,* **21** (6) : 2061-2074.

Otles, S. and Caginidi, O. (2006) Cereal based functional foods and nutraceuticals. *Acta Sci Pol Technol Alignment,* **5** (1) : 107-112.

Patil, S.H., Shere, P.D., Sawate, A.R. and Mete, B.S. (2017). Effect of hydrocolloids on textural and sensory quality of date mango leather. *J. Pharmocog & Phytochem.,* **6** (5) : 399 - 402.

Ranganna, S. (2001). *Hand book of analysis and quality control of fruit and vegetable products*. Published by Tata McGrew Hill Publishing Company Limited, New Delhi, India.

Shewry, P.R. (2009). "Wheat", *J. Experimental Botany*, **60** (6): 1537–1553.

Szczesniak, A.S. (1975). Classification of textural characteristic. *J. Food Sci.*, **28** (4) : 385-389.

Tang, Q., Mccarthy, O.J. and Munro, P.H. (1995). Effect of pH on where protein concerted gal properties: composition between small deformation (dynamic) and large deformation (failures) testing . *J. Texture Studies,* **26**:255-272.

Thavani, M., Mahendran, T. and Kanimoly, M. (2016). Quality and shelf-life of pineapple powder biscuits. *Ruhuna J. Sci.,* **7** : 32-42.

WEBLIOGRAPHY

USDA (2016). United States Department of Agriculture Grain: World Markets and Trade. Available online *https://www.fas.usda.gov/data/grain-world-markets-and-trade.*

USDA (2019). U. S. Department of Agriculture, Agriculture research Service FoodData Central, 169716-20067. *https://fdc.nal.usda.gov/fdc-app.html#/160716/nutrients.*

Received : *14.07.2020;* **Revised :** *26.08.2020;* **Accepted :** *26.09.2020*