Sustainability, Agri, Food and Environmental Research, (ISSN: 0719-3726), vol 13, 2025
http://dx.doi.org/

Development and comparison of sensory attributes of cowpea curd with green gram curd in three different flavours

Desarrollo y comparación de los atributos sensoriales de la cuajada de caupí con la cuajada de frijol mungo en tres sabores diferentes

R.Radha[1a], Pavatharani.S[2b]

Assisstant Professor (SG), Department of Food Service Management and Dietetics, Avinashilingam Institute for Homescience and Higher Education for Women, Coimbatore-43.

ABSTRACT

The aim of the study is to develop a vegan cowpea curd and green gram curd with three different flavours. The pulses selected to develop vegan curd was cowpea and green gram. Both the pulses were soaked, germinated, and ground to extract the milk. The filtered milk was then boiled and added with starter culture. *Lactobacillus plantarum* was added to ferment the cowpea milk. After fermentation, the curd from both the pulse was separated into three and added with three different flavours such as mango, strawberry, and chocolate. Organaoleptic evaluation was done to find the best flavour with the five point hedonic scale. Mango flavoured cowpea curd scored the highest in the sensory evaluation test compared to other two flavours. The developed curd will provide another way to increase the consumption of plant based probiotics and nutrients to people who are on a vegan diet as well as lactose intolerant subjects.

RESUMEN

El objetivo del estudio es elaborar una cuajada vegana de caupí y de frijol mungo con tres sabores diferentes. Las legumbres seleccionadas para elaborar la cuajada vegana fueron el caupí y el frijol mungo. Ambas legumbres se remojaron, germinaron y molieron para extraer la leche. A continuación, se hirvió la leche filtrada y se le añadió un cultivo iniciador. Se añadió *Lactobacillus plantarum* para fermentar la leche de caupí. Tras la fermentación, la cuajada de ambas legumbres se separó en tres y se añadió con tres sabores diferentes como mango, fresa y chocolate. Se realizó una evaluación organoléptica para encontrar el mejor sabor con la escala hedónica de cinco puntos. La cuajada de caupí con sabor a mango obtuvo la puntuación más alta en la prueba de evaluación sensorial en comparación con los otros dos sabores. La cuajada desarrollada proporcionará otra forma de aumentar el consumo de probióticos y nutrientes de origen vegetal a las personas que siguen una dieta vegana, así como a los sujetos intolerantes a la lactosa.

INTRODUCTION

Indian diets have cereals as their staple food for many years and it derives protein with relatively low digestibility and quality (Swaminathan *et al*. 2012). Imbalance in the intake of nutrients will cause problems like protein deficiency, protein-energy malnutrition and micronutrient deficiencies (Ghosh, 2016). Pulses and legumes are also called as poor man's meat, due to its protein content (Merga & Haji, 2019).

Cowpeas (*Vigna unguiculata* L.) and green gram (*Vigna radiata* L.*)* are the pulse belong to the Family Fabaceae. They consists phenolic compounds, minerals, B-vitamins, soluble and insoluble fibre and some other functional compounds. Phytochemicals and functional compounds such as resistant starch, present in cowpea provides beneficial effects towards weight gain and diabetes. Green gram has high digestability comparing with other pulses. Also, like some other legumes it contains some anti-nutritional factors and it can be overcome by the processing methods. The present study aims to develop a vegan curd using cowpea and it can be added with flavours to increase the taste and overall acceptability. It can be taken by the vegan people who are lack in their daily protein intake. Moreover, curd is a probiotic which is essential to maintain the gut health of human.

MATERIAL AND METHODS

Among different pulses and legumes, cowpea and green gram was selected to develop vegan curd based on its therapeutic value. Milk was extracted and fermented with the lactobacillus starter culture. And finally added with the natural flavours of mango (*Mangifera indica*), strawberry (*Fragaria ananassa*) and cocoa powder (*Theobroma cacao*). All the developed vegan curds were evaluated for its sensory characters with five point hedonic scale.

Preparation of starter culture:

Starter cultures are bacterial colonies help to ferment the products in which they are added. Common starter culture species used was lactobacillus and bifidobacterium. In the present study *lactobacillus plantarum* was procured form the microbiological laboratory of Tamil Nadu Agricultural University (TNAU) in freeze dried form. It was revived with 50ml of water and used to ferment the extracted cowpea milk.

Preparation of natural flavouring:

Mango flavour- Ripe mangoes were washed and their skin was peeled. The mangoes were deseeded and pulp was separated. Then the pulp was ground to a smooth paste by adding sugar. Subsequently 10 ml of pulp paste was added to the developed variants.

Strawberry flavour- Here the strawberries were washed and dried. They were subsequently cleaned and ground into a smooth paste with some added sugar. 10ml of the prepared strawberry pulp was added to the varieties of developed curd fermented with the lactobacillus species.

Chocolate flavour- For chocolate flavour, cocoa was procured in the form of powder. The powder was blended with sugar and water. This was made it into syrup consistency. 5ml of this cocoa syrup was added to the vegan curd varieties fermented with the different lactobacillus species.

Milk extraction:

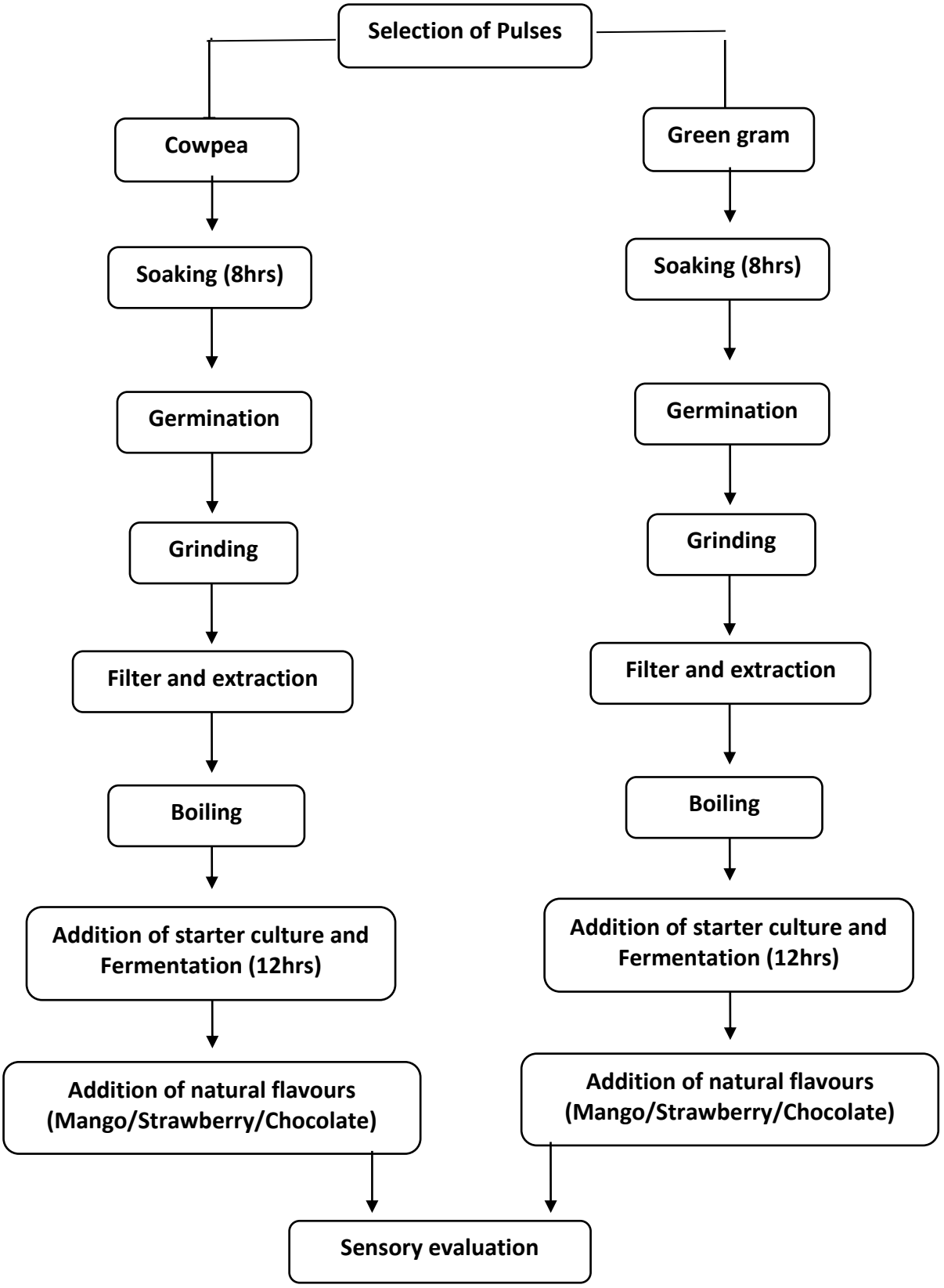
200g of cowpea and 200g of green gram was purchased from the local grocery shop of Coimbatore. Both pulse was cleaned, washed, dried and soaked for 8hrs. Then it was drained and closed with the porous cloth overnight for germination. Germinated cowpea and green gram were ground separately into a smooth mixture along with water and extracted. Filtered milk from cowpea and green gram was boiled until it get thickens. When it reaches the room temperature, *lactobacillus plantarum* starter culture was added for fermentation for up to 12hrs. Fermented curd was flavoured with three different natural flavours such as mango, strawberry and chocolate in a separate bowls.

Sensory evaluation:

Sensory evaluation is a scientific discipline that applies principles of experimental design and statistical analysis to the use of human senses for the purpose of evaluating consumer products. There are several sensory methods to evaluate a product (Srilakshmi, 2015). Sensory evaluation was done for all the developed curds by a group of ten members. The panellists were ph.d scholars of Food Service Management and Dietetics department.

The coded samples were presented to each of the panelist. Each panelist tasted all the samples of vegan curd and scored. 5-point hedonic scale indicates that 1 = dislike very much, 2 = dislike slightly, 3 = neither like nor dislike, 4 = like slightly, 5 = like very much. Sensory evaluation was practiced according to the procedures given by the International Food technologist (IFT, 2017).

FLOW CHART


Selection of Pulses
Cowpea
Green gram
Soaking (8hrs)
Soaking (8hrs)
Germination
Germination
Grinding
Grinding
Filter and extraction
Filter and extraction
Boiling
Boiling
Addition of starter culture and Fermentation (12hrs)
Addition of starter culture and Fermentation (12hrs)
Addition of natural flavours (Mango/Strawberry/Chocolate)
Addition of natural flavours (Mango/Strawberry/Chocolate)
Sensory evaluation

RESULTS AND DISCUSSION

Masood *et* al., in 2014 states that during germination protein content of pulses get improved due to the synthesis of enzymes like proteases. It was found that, there is an increase in the amount of sucrose in the germinated pulses because of the degradation of raffinose (Cai *et al*., 1997; Makinen and Arendt 2015). In the study of Patterrson *et al.,* (2017) pointed that germination as the more effective process for reducing phytic acid (anti-nutrient) in pulses.

Moreover, Fermentation process helps in the removal of raffinose, ciceritol and stachyose and decreases the oligosaccharides, which cause flatulence.

Table I indicates the sensory the scores of the developed vegan cowpea curd and green gram curd. It highlights that, the sensory score was significantly higher at 0.01 percent for cow pea curd followed by green gram curd.

In cowpea curd, appearance and colour of mango and chocolate flavoured curd scores higher than strawberry flavour. In texture, strawberry flavoured curd scores high followed by mango and chocolate. Whereas by flavour, mango flavoured curd scores higher than strawberry followed by Chocolate. Based on taste, strawberry and chocolate flavour scores same but lesser than mango.

In green gram curd, for appearance strawberry flavoured curd score higher than mango and chocolate. Based on colour, mango flavoured curd scored high followed by chocolate and strawberry. For texture, all the three curds scored equal. According to flavour, mango flavoured curd scores more than chocolate next to strawberry. Whereas by taste, mango flavoured curd scored high and strawberry and chocolate scored equal.

TABLE I SENSORY EVALUATION OF COWPEA CURD AND GREEN GRAM CURD

	Cowpea curd			Green gram curd		
	Mango	Strawberry	Chocolate	Mango	Strawberry	Chocolate
Appearance	4.80 ± 0.42	4.40 ± 0.51	4.80 ± 0.42	3.80 ± 0.51[a**]	4.00 ± 0.00[a**]	3.60 ± 0.42[a**]
Colour	5.00 ± 0.00	4.40 ± 0.51	5.00 ± 0.00	3.80 ± 0.42[a**]	1.00 ± 0.00[a**]	2.00 ± 0.00[a**]
Texture	4.80 ± 0.42	5.00 ± 0.00	4.00 ± 0.00	4.80 ± 0.42	4.80 ± 0.42[a**]	4.80 ± 0.42[a**]
Flavour	3.60 ± 0.51	3.20 ± 0.78	2.80 ± 0.42	3.00 ± 0.00[a**]	2.60 ± 0.84[a**]	2.00 ± 0.66[a**]
Taste	4.00 ± 0.00	3.80 ± 0.42	3.80 ± 0.42	4.00 ± 0.00	3.00 ± 0.00[a**]	3.00 ± 0.00 [a**]
Overall acceptability	4.28 ± 0.24	4.16 ± 0.36	4.24 ± 0.16	3.68 ± 0.10[a**]	3.08± 0. 16[a**]	3.28± 0. 16[a**]

Values are Mean ± SD. 'a' denotes significant difference at 5% level between cow pea curd and green gram curd. '**' shows p value <0.01.

FIGURE I COMPARISON OF CURD BASED ON FLAVOURS

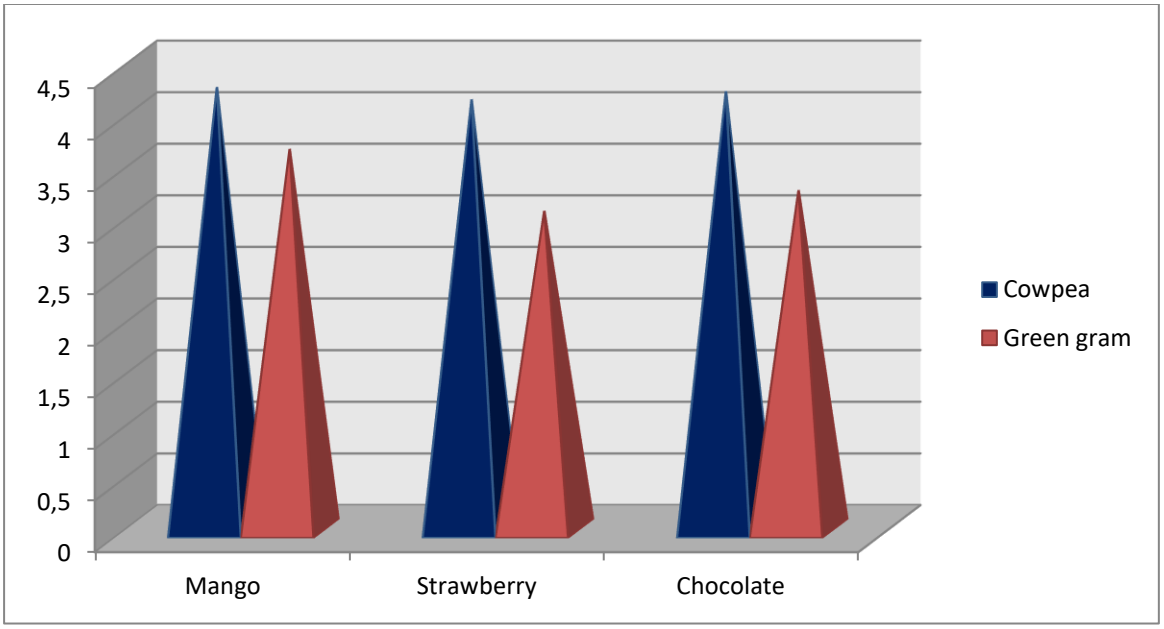
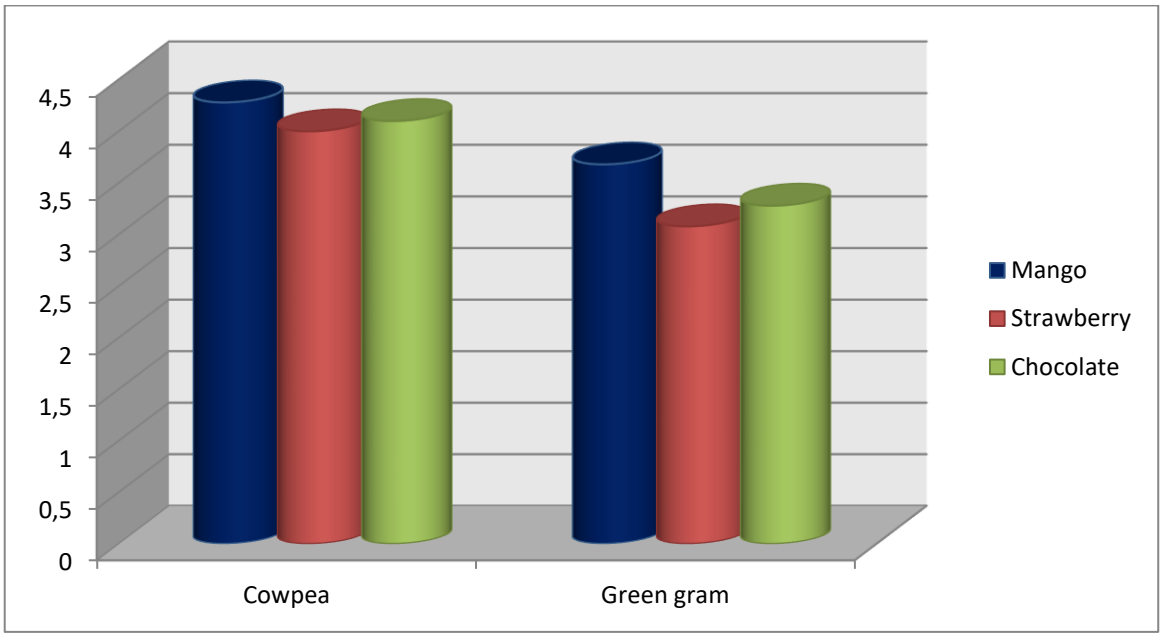


Figure I depicts the comparison of curd based on the flavours, which clearly shows that cowpea curd scores high in all the three flavours than green gram curd. Due to the aspects like good texture, appearance and reduction in off-flavour of cowpea curd, it was more acceptable than green gram curd.

FIGURE II COMPARISON OF FLAVOURS BASED ON CURD



From figure II, it was clear that in case of overall acceptability mango flavoured curd scores higher than chocolate flavoured curd in both type pulse and strawberry flavour scores least. A study by Teshome *et al.,* (2017) evident that, addition of flavour in appropriate amount will increase the sensory attributes of curd. Mango flavours scores high may be due to its natural sweetness and appetizing colour. In comparison strawberry flavour scores least with orange and grape flavoured curd, reported by Hossain *et al.,* (2012).

From the above data, Mango flavoured cowpea curd scores the highest overall acceptability followed by chocolate flavoured cowpea curd and strawberry flavoured cowpea curd. Strawberry flavoured green gram curd scores the least overall acceptability score.

CONCLUSION

The study provides an alternate to curd from cow milk, which can be consumed by people who are lactose intolerant and vegans. As cowpea contains more beneficial compounds and rich in nutrients it can compensate the nutrient deficiency. Additionally, it was developed by germination and fermentation process, which reduces the anti-nutrients present in the cowpea. Probiotics has many health benefits such as preventing chronic diseases like cancer, diabetes, CVD, boosts immunity by colonic resistance mechanism and helps to maintain a healthy gut.

REFERENCES

Aydar, E. F., Tutuncu, S., & Ozcelik, B. (2020). Plant-based milk substitutes: Bioactive compounds, conventional and novel processes, bioavailability studies, and health effects. Journal of Functional Foods 70(103975). https://doi.org/10.1016/j.jff.2020.103975

Babaji, P., Keswani, K., Lau, H., Lau, M., Punga, R., & Sharma, N. (2012). Role of probiotics in oral health: A review of the literature. Journal of Education and Ethics in Dentistry, 2(2), Pg.no: 52. https://doi.org/10.4103/0974-7761.121256

Cai Y, Ng LK, Farber JM. (1997). Isolation and characterization of nisin-producing Lactococcus lactis subsp. Lactis from bean-sprouts. J Appl Microbiol. 83:499–507.

Chandrasekhar, (2002). Food science and applications in Indian cookery, Phoenix publishing house pvt ltd. Pg.no:158, ISBN: 81-7484-060-5.

Cheng, Y. J., Thompson, L. D., & Brittin, H. C. (1990). Sogurt, a Yogurt-like Soybean Product: Development and Properties. Journal of Food Science, 55(4), 1178–1179. https://doi.org/10.1111/j.1365-2621.1990.tb01631.x

COHAB initiative-corporation of health and biodiversity., (2010).

Collado, M., Isolauri, E., Salminen, S., & Sanz, Y. (2009). The Impact of Probiotic on Gut Health. Current Drug Metabolism, 10(1), 68–78. https://doi.org/10.2174/138920009787048437

Cravotto, G., & Cintas, P. (2007). Extraction of flavourings from natural sources. Modifying Flavour in Food (pp. 41–63). https://doi.org/10.1533/9781845693367.41

Dave R & Shah NP (1997) Viability of probiotic bacteria in yoghurt made from commercial starter cultures. Int Dairy J, 7, Pp: 31–41.

de Albuquerque, E. M. B., Almeida, F. de A. C., Gomes, J. P., Alves, N. M. C., & da Silva, W. P. (2013). Production of "peanut milk" based beverages enriched with umbu and guava pulps. Journal of the Saudi Society of Agricultural Sciences, 14(1), 61–67. https://doi.org/10.1016/j.jssas.2013.07.002

de Vrese, M., Stegelmann, A., Richter, B., Fenselau, S., Laue, C., & Schrezenmeir, J. (2001). Probiotics—compensation for lactase insufficiency. The American Journal of Clinical Nutrition, 73(2), 421s-429s. https://doi.org/10.1093/ajcn/73.2.421s

FM, M. (2017). Nutritional and Sensory Properties of Cashew Seed (Anacardium occidentale) Milk. Modern Concepts & Developments in Agronomy, 1(1). https://doi.org/10.31031/mcda.2017.01.000501

Gamli, Ö. F., & Atasoy, A. F. (2018). Physico-chemical and sensorial properties of groundnut milk and it's yoghurt. Journal of Food Measurement and Characterization, 12(3), 1997–2004. https://doi.org/10.1007/s11694-018-9814-4

George Kerry, R., Patra, J. K., Gouda, S., Park, Y., Shin, H. S., & Das, G. (2018). Benefaction of probiotics for human health: A review. Journal of Food and Drug Analysis, 26(3), pp. 927–939. https://doi.org/10.1016/j.jfda.2018.01.002

Gill, H. S., & Guarner, F. (2004). Probiotics and human health: A clinical perspective. In Postgraduate Medical Journal 80(947), pp. 516–526. https://doi.org/10.1136/pgmj.2003.008664

Hossain MN, Fakruddin M, Islam MN (2012) Quality Comparison and Acceptability of Yoghurt with Different Fruit Juices. J Food Process Technol 3:171. doi:10.4172/2157-7110.1000171.

IFT (Institute of food Technologists) (2017). Sensory Evaluation Methods. The Society for the Food Technologists, Chicago, IL.

Janssen, M., Busch, C., Rodiger, M., & Hamm, U. (2016). Motives of consumers following a vegan diet and their attitudes towards animal agriculture. Appetite, 105, 643–651

Jayathilake, C., Visvanathan, R., Deen, A., Bangamuwage, R., Barana C Jayawardana, Nammi, S., and Liyanage, R., (2018), Cowpea: an overview on its nutritional facts and health benefits, J Sci Food Agric, DOI 10.1002/jsfa.9074

Kebede & Bekeko, (2020), Expounding the production and importance of cowpea (Vigna unguiculata (L.) Walp.) in Ethiopia Cogent Food & Agriculture, 6: 1769805 https://doi.org/10.1080/23311932.2020.176980

Makinen OE, Arendt EK. (2015). Non-brewing applications of malted cereals, pseudocereals and legumes: a review. J Am Soc Brew Chem. 73:223–227.

Makinen, O. E., Wanhalinna, V., Zannini, E., & Arendt, E. K. (2016). Foods for special dietary needs: Non-dairy plant-based milk substitutes and fermented dairy-type products. Critical reviews in food science and nutrition, 56(3), 339–349.

Masood T, Shah HU, Zeb A. (2014). Effect of sprouting time on proximate composition and ascorbic acid level of mung bean (Vigna radiate L.) and chickpea (Cicer arietinum L.) seeds. J Anim Plant Sci. 24:850–859.

Merga & Haji, (2019), Economic importance of chickpea: Production, value, and world trade, Cogent Food & Agriculture, 5: 1615718, https://doi.org/10.1080/23311932.2019.1615718

Mudryj, A. N., Yu, N., & Aukema, H. M. (2014). Nutritional and health benefits of pulses. In Applied Physiology, Nutrition and Metabolism 39(11), pp. 1197–1204. https://doi.org/10.1139/apnm-2013-0557

Nguyen, T.D., Kang, J.H., Lee, M.S., 2007. Characterization of Lactobacillus plantarum PH04, a potential probiotic bacterium with cholesterol lowering effects. Int. J. Food Microbiol. 113, 358–361.

Owade, J.O., Abong, G., Okoth, M., ombe, A.W., (2019), A review of the contribution of cowpea leaves to food and nutrition security in East Africa, *Food Sci Nutr.*;8:36–47.DOI: 10.1002/fsn3.1337

Patterson CA, Curran J, Der T. (2017). Effect of processing on antinutrient compounds in pulses. Cereal Chem. 94:2–10.

Polak, R., Phillips, E. M., & Campbell, A. (2015). Legumes: Health benefits and culinary approaches to increase intake. Clinical Diabetes, 33(4), 198–205. https://doi.org/10.2337/diaclin.33.4.198

Potter and Hotchkiss, (1995). Food science, 5th edition, International Thompson publishing. Pg.no:30.

Rai, S. R., Pachisia, J., & Singh, S. (2018). A Study on the Acceptability of Plant-Based Milk and Curd among the Lactose Intolerant People Residing in Kolkata. International Journal of Health Sciences & Research, 8(12), 12. www.ijhsr.org

Rampal, P. (2018). An Analysis of Protein Consumption in India Through Plant and Animal Sources. Food and Nutrition Bulletin, 39(4), 564–580. https://doi.org/10.1177/0379572118810104

Rao, D. R., Pulusani, S. R., & Chawan, C. B. (1985). Role of fermented milk products in milk intolerance and other clinical conditions. In Advances in nutritional research (Vol. 7, pp. 203–219). https://doi.org/10.1007/978-1-4613-2529-1_8

Sakthi, T. S., Meenakshi, V., Kanchana, S., & Vellaikumar, S. (2020). Study on Standardisation and Quality Evaluation of Peanut Milk by Different Processing Methods. European Journal of Nutrition & Food Safety, 1, 60–72. https://doi.org/10.9734/ejnfs/2020/v12i530228

Sethi, S., Tyagi, S. K., & Anurag, R. K. (2016). Plant-based milk alternatives an emerging segment of functional beverages: a review. In Journal of Food Science and Technology 53(9), pp. 3408–3423. https://doi.org/10.1007/s13197-016-2328-3

Severini, C., Giuliani, R., De Filippis, A., Derossi, A., & De Pilli, T. (2016). Influence of different blanching methods on colour, ascorbic acid and phenolics content of broccoli. Journal of Food Science and Technology, 53(1), 501–510. https://doi.org/10.1007/s13197-015-1878-0

Sheela, P., moorthy UmaMaheswari, T., Kanchana, S., Kamalasundari, S., & Hemalatha, G. (2018). Development and evaluation of fermented millet milk based curd. ~ 714 ~ Journal of Pharmacognosy and Phytochemistry, 7(4), 714–717.

Shivakumar, N., Minocha, S., & Kurpad, A. (2018). Protein quality & amino acid requirements in relation to needs in India. Indian Journal of Medical Research, 148(5), 557. https://doi.org/10.4103/ijmr.IJMR_1688_18

Swaminathan, S., Vaz, M., & Kurpad, A. V. (2012). Protein intakes in India. British Journal of Nutrition, 108(SUPPL. 2). https://doi.org/10.1017/S0007114512002413

Tangyu, M., Muller, J., Bolten, C. J., & Wittmann, C. (2019). Fermentation of plant-based milk alternatives for improved flavour and nutritional value. In Applied Microbiology and Biotechnology 103(23–24), pp. 9263–9275. https://doi.org/10.1007/s00253-019-10175-9

Teshome, G., Keba, A., Assefa, Z., Agza, B., Kassa, F., (2017), Development of Fruit Flavored Yoghurt with Mango (Mangifera indica L.) and Papaya (Carica papaya L.) Fruits Juices, Food Science and Quality Management, Vol.67, ISSN 2224-6088 (Paper), ISSN 2225-0557 (Online).

Yadav, D. N., Singh, K. K., Bhowmik, S. N., & Patil, R. T. (2010). Development of peanut milk-based fermented curd. International Journal of Food Science & Technology, 45(12), 2650–2658. https://doi.org/10.1111/j.1365-2621.2010.02446.x

Received: 11th April 2022; Accepted: 19th January 2023; First distribution: 25th April 2023.