The Pharma Innovation Journal 2021; 10(10): 1749-1754

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(10): 1749-1754

www.thepharmajournal.com
Received: 28-08-2021
Accepted: 30-09-2021

Pathare Aniket Murlidhar
Research Scholar, M. Tech, Food Processing Business Incubation Centre, Indian Institute of Food Processing Technology, Thanjavur, Tamil Nadu, India

Bhosale Yuvraj Khasherao
Research Scholar, Ph.D., Food Processing Business Incubation Centre, Indian Institute of Food Processing Technology, Thanjavur, Tamil Nadu, India

V Hema
Assistant Professor, Food Processing Business Incubation Centre, Indian Institute of Food Processing Technology, Thanjavur, Tamil Nadu, India

Corresponding Author:
V Hema
Assistant Professor, Food Processing Business Incubation Centre, Indian Institute of Food Processing Technology, Thanjavur, Tamil Nadu, India

Effect of different treatment on the quality attribute of composite flour from kodo millet & almond used in the development of pellet through compression moulding techniques

Pathare Aniket Murlidhar, Bhosale Yuvraj Khasherao and V Hema

Abstract
Millets are nutritionally denser among all the cereals. The value addition and effective utilization of millet is an increasing trend among the globe. Pellets are the basically manufactured from sugar-based confection and widely consumed by all age group. The purpose of this study is to development of pellets from different treated composite flour of almond millet. Further, the effect of these composite flour on flowing properties and its effect on quality of compression were studies. The raw, roasted (at 120^{0}c for 5 min), germinated and fermentation were carried out the resultant flour used for pellet development and flour properties estimation. The flour properties includes bulk density, tapped density, WAC, OAC, water solubility, Hausner ratio (H) and Carr's index (CI) and textural analysis. The resultant flour used for pellets were manufacturing in the substitution of kodo millet and almond flour in 70:30 ration w/w. Further, pellet was manufactured by addition of binder, liquid glucose and lubricant through wet granulation by using compression moulding technique. The study demonstrated that, germinated and fermented flour having higher tapped 0.66±0.02, 0.51±0.02 and bulk density 0.48±0.00, 0.37±0.02, water solubility (3.00±1.00), Hausner ratio 1.38, 1.37 and Carr's index 27.27, 27.45 respectively compared to other. The developed pellet having higher protein content 9.3±0.06 fermented and 8.4±0.02 germinated pellet with higher compressibility and hardness around 22.84±0.03 and 25.93±0.05 compared among all the pellets sample.

Keywords: pellet, kodo millet, flour properties, hardness, compression moulding technique

1. Introduction
Millets are considered nutrient-dense food. However, due to the lack of effective utilization of millet, processing technology remains a big challenge due to its unpleasant taste, less acceptability in developing as well as developed countries. Evidence reported that the consumption of millets is effective over various health-related problems such as reduce the risk of diabetes mellitus, cardiovascular diseases, heart disease, ischemic stroke, obesity, breast cancer, childhood asthma, premature death and insulinemic response (Nambiar *et al*. 2011) [6]. Traditionally millets are consumed in the form of porridge and malt are ideal for infant food (Taylor 2017) [17]. Kodo millet contains 6.2 ± 0.0% protein, 3.6 ± 0.0% ash, 26.5 ± 0.9 mg/g free lipid, 2.2 ± 0.13% soluble dietary fibre, 31.7 ± 0.2 g/100 g insoluble dietary fibre, 2518 ± 36.0 µg/g free phenolic content and 7570 ± 50.0 µg/g bound phenolic content (Deshpande *et al*. 2015) [1]. Kodo Millet has an excellent nutritional profile but due to the presence of antinutritional factors, its effects on their digestibility as well as bioavailability. The various treatments such as soaking, steaming, roasting, blanching, germination, fermentation etc. are used to reduce these antinutritional factors (Sharma, Saxena, and Riar 2015) [13]. To retain its natural available nutrients, and effective utilization of millet solution is that adequate processing with value addition.
The tablet or pellet development is mostly involved in the pharmaceutical industry, mostly used for the manufacture of drug delivery related products (Salleh *et al*. 2015) [11]. There are no studies on the food-based tablet using millets are available but the confectionary based sugar-based flavoured tablets available such as polo. Compression of any powdered form material still has the big challenges to retain its stability and maintain its textural profile. The various factors are responsible for the stability of tablets such as nature of flour base, flowability, density, particle size, ingredients used (binder, its concentration used, lubricant, stabilizer used, base binder interactions) etc (Osorio-Fierros *et al*. 2017) [8].

However, the process parameters like pressure used, the thickness of the tablet, speed, time of compression and shear stress have a direct or indirect effect on the quality of the tablet.
Whereas, nuts were used to improve the sensory properties with additional nutritional benefits shared due to high protein and essential sugar profile. No more knowledge is available on direct substitution or utilization of kodo millet as a supplementary or alternative over the other. This objective of the study, effect of different treatment on kodo millet and their effective utilization in the development of compressed pellet. In the present study, the physicochemical effect of different treatments such as raw, roasting, germination and fermentation on kodo mill*et al*ong with almond nut was studied. Kodo mill*et al*ong with almond was used for the development of food-based pellet. Furthermore, the study evaluates the effect of different treatments on flour properties and compressibility and textural properties.

2. Materials and Methods

The major ingredient such as kodo millet (*Paspalum Scrobiculatum*) was procured from South Indian Grain Corporation Ltd., Paramakudi, Tamil Nadu. The almond was purchased from Cooperative Stores, Thanjavur, Tamil Nadu. All chemicals used in this study were of analytical grade. The chemicals and reagents used are of analytical grade and purchased from Hi-Media Ltd, the multi-elemental standards from LOBA Chemie, Mumbai, India was used for mineral analysis.

2.1 Preparation of variously treated millet flour

The dehulled kodo millet flour was cleaned and sieved to remove the foreign materials. For roasting the kodo grains and almonds were roasted at a temperature around 120^0 c for 5 min. In the case of germination raw hulled grain was conditioned for 12 hr at room temperature. Further, grains were tied using a muslin cloth and kept for 24 hr at R. T with a regular sprinkling of water at an interval of 4 hr. Then the germinated grains were dried at 60^0 C for 10 hr to reduce moisture contain around 8-10%. The grains were dehulled using a polisher (satake). The obtained grain such as raw, roasted and germinated was dry milled using a laboratory-scale hammer miller (laboratory Mill 3100, Perten co.).
In the case of fermentation, kodo millet grains were conditioned for 12 hr using 1:3 water. Wet milling for kodo grain was done using a water ratio of 1:1 w/v and almond 1:3 w/v in a colloidal mill (Pilotsmith India Private Limited Thrissur, Kerala). The temperature of the milk was 30°C at 3000 rpm for 12 minutes, pasteurization at 65°C for 15 min followed by cooling. The milk was fermented using *L. pantarum* strain at 37^0 c for 8 hr. The fermented milk was dried using the refracto window dryer was fabricated with hot water containing food-grade polyester (RET) for 40^0 c for 2 hrs. The resultant flakes obtained was ground in a mixer.
The resulting all treated millet flour was packed in polyethene bags and stored in a refrigerator for further product development and analysis.

2.2 Development of pellet

All the three treated along with raw kept as control sample used development of compressed candy. The millet-based candy was developed using the compression moulding technique followed by the wet granulation method. The wet granulation method involves the use of flour base (almond and kodo mix), sweetener sugar, liquid glucose, stabilizer xanthan gum, lubricant steric acid etc. The wet granulation method includes dry mixing of base and sugar, flowed by addition of xanthan gum and liquid glucose still it attains dough-like consistency (Kumar *et al*. 2013) [3]. The prepared candy based was wet sieved using 0.45 mesh size to attain uniform particle size. Then the resultant base was dried in a conventional try dryer to reduce the moisture at 60^0 c for 30 min. The flour base was mixed with lubricant steric acid and then compressed using the compression moulding method at 20 rpm.

3. Physicochemical properties

3.1 Nutritional analysis

The method described in (Official Methods of Analysis n.d.) was used for determining moisture content. The protein content and fat content were estimated by determining total nitrogen content using standard Micro-Kjeldhal and Soxhlet apparatus as described by A.O.A.C. The crude fibre content and ash in the products was estimated by A.O.A.C. The carbohydrate content was obtained by subtracting from 100, the sum of values of moisture, protein, fibre, ash and fat content per 100 g of the sample. The energy value of the samples was determined by multiplying the protein content by 4, carbohydrate content by 4 and fat content by 9 (Theagarajan *et al*. 2019) [18].

3.2 Flow properties of the flour mix

The flowing nature of various treated flour bases is critical for determining the impact of compression on flowability. The purpose of this study was to determine the flour's binding qualities. Bulk density, tapped density, Hausner ratio, and Carr's index were used to examine the various flow properties of the base.

3.3 Bulk density and tapped density

The bulk density (ρ_B) and tapped density (ρ_T) of different treated flour bases were evaluated by the procedure. A known quantity (10 g) of flour base were taken and filled in 50 ml measuring cylinder and softly tapped thrice to remove the upper portion on the surface of a cylinder and remove the extra voids to note down the volume (V_I). The BD was calculated by equation. The tapped density was measured by tapping the measuring cylinder 300 times and the volume of the sample (V_T) was read and calculated by equation (Sharanagat *et al*. 2019a) [12].

$$\text{Bulk density} = \left(\frac{M}{V_I}\right)$$

$$\text{Tapped density} = \left(\frac{M}{V_T}\right)$$

where M is mass of flour base and V_I and V_T are volumes for bulk and tapped condition respectively.

3.4 Hausner ratio (H) and Carr's index (CI)

Flow characteristics of different flour bases were estimated through Hausner ratio (HR) and Carr's index (CI), by taking ratio ρ_B and ρ_T. Further calculated through the following equations (Sharanagat *et al*. 2019b).

$$\text{Hausner ratio} = \left(\frac{\rho_T}{\rho_B}\right)$$

$$\text{Carr's index} = \left(\frac{\rho_T - \rho_B}{\rho_T}\right) \times 100$$

where ρ_T is tapped density and ρ_B is bulk density

3.5 Water absorption capacity
One-gram flour base (W_S) was taken in a pre-weighed centrifuge tube (W_T). After that, ten millilitres of deionized water were added to the tube. The mixture was homogenized through a vertex mixer (CM-101, Remi Laboratory Instruments, Mumbai, India) and allowed to rest for 30 min at room temperature. The sample was then centrifuged at 3000 rpm for 30 min (R-8C, Remi Laboratory Instruments, Mumbai, India). Supernatant water was discarded after centrifugation and centrifuge tubes were kept inverted for 5 min on a paper towel to remove the excess amount of water holed in the samples. The final weight (W_F) of the sample was taken and water absorption capacity was calculated using equation (Sharanagat *et al*. 2019b).

3.6 Oil absorption capacity
One-gram flour base (W_S) was added in a pre-weighed centrifuge tube (W_T). After that, ten millilitres of oil was added to the tube. The suspension was homogenized using a vortex mixer (CM-101, Remi Laboratory Instruments, Mumbai, India) and allowed to rest for 30 min at room temperature. The sample was then centrifuged at 3000 rpm for 30 min (R-8C, Remi Laboratory Instruments, Mumbai, India). Supernatant oil was discarded after centrifugation and the centrifuge tubes were kept inverted on a paper towel for 5 min to remove the excess amount of oil present in the samples. The final weight (W_F) of the sample was taken and oil absorption capacity was calculated using equation (Sharanagat *et al*. 2019b).

$$\text{Water and Oil Absorption Capacity} = \left(\frac{W_F - (W_S + W_T)}{W_S}\right) 100$$

where W_F is the final weight, W_S is the weight of the sample and W_T is the weight of an empty centrifuge tube.

3.7 Water solubility index
One-gram flour mix samples were weighed (W_S) and added to centrifuge tubes. Followed by the addition of ten ml deionized water and homogenized by a vortex mixer for 1 min (CM-101, Remi Laboratory Instruments, Mumbai, India). The mixture was then centrifuged at 3000 rpm for 30 min (R-8C, Remi Laboratory Instruments, Mumbai, India). The supernatant was taken in a pre-weighed drying dish (W_D) after centrifugation and dried at 60°C for 24 h and the final weight of the samples were recorded (W_F). The water solubility index was calculated by equation.

$$\text{Water Solubility Index} = \left(\frac{W_F - (W_S + W_D)}{W_S}\right) 100$$

where W_F is the final weight, W_S is the weight of the sample and W_D is the weight of an empty petri dish.

3.8 Texture analysis
The hardness of developed pellets was analysed for texture usia ng texture analyser (TA-HD plus TPA). The program run was the comparison of the hardness of pellets by compression through measure force in compression mode. A hundred kg load cell was mounted on the equipment which triggers the measurement after touching the pellet sample. The pellet sample was on a heavy-duty platform (HDP/90) so that it remains in the most stable position. The test was performed with a 35 mm cylindrical probe (P/35) with a pre-test speed of 2.0 mm/sec, test speed 2.0 mm/sec and after the data acquisition, post-test speed of 10 mm/sec. The hardness was considered at the highest point on the plot at which the pellet sample breaks (Mohapatra, Yuvraj, and Shanmugasundaram 2016) [5].

3.9 Statistical analysis
Statistical analysis was carried out by using one-way analysis of variance (ANOVA), MINITAB-17 was used as a statistical tool to perform Tukey honest significance difference for comparing means at a 95% significance level.

4. Results and Discussion
4.1 Nutritional analysis of pellet
The physicochemical properties of the developed pellet were prescribed in table 1. The protein contains among all pellets showed a significant difference at 95%. The higher protein was observed in fermented pellet followed by germinated. This is due to the microbial fermentation of the pellet base which enhances the protein content by fermentation. Fermented and germinated pellets having no significant difference compared to raw and roasted. In germinated pellet, the starch was converted into the complex polysaccharide to simpler sugars (Sharma, Saxena, and Riar 2015) [13]. Hence the starch matrix releases the bounded protein moieties and increases the protein content. In roasting the due to stanch gelatinisation leads results in the protein being more available. Similar results were reported in microwave treated kodo millet (Sharanagat *et al*. 2019b) study Decreasing trend was observed in lipid profile compared to raw. Due to the processing method, it involved it varies, fatty profile mostly contains the unsaturated fatty acids which is present not only in kodo millets but also the almond (Devnani *et al*. 2020) [2]. These fatty acids having good health benefits and are also considered a healthy fat. Fibre contains among all the pellets showed non-significant difference statistically. A similar, decreasing trend was observed in the case of fibre reported in fig1. The processes like roasted results in gelatinization of stanch which leads to causes entrapped of fibre molecules in the goblinized starch matrix, while in germination the breakdown of complex macromolecules due to the activity of the natural enzyme responsible of degradation of fibre content. Fermentation leads to the microbial breakdown of starch besides the consumption of higher fibrous material (Shibata *et al*. 2007) [14].

4.2 Bulk density and tapped density
The bulk density was significantly reduced with a change in treatment. It was found that the raw flour showing the highest bulk density 0.49±0.01^a followed by roasted 0.42±0.02^a, germination 0.48±0.00^b and fermented 0.37±0.02^c flour. A similar trend was observed during tapped density showed in table 2. Higher BD and TP due to high starch content and particle size. Roasting shows the decrease in BD and TP due to direct heating through the flame results in starch gelatinization followed by the puffing of grain. The milling leads to the fragmentation of complex molecules into sub-subunits that may be having a less bulky nature. In germination BD and TP was observed higher than roasted

flour, this may be due to the almond portion. Almond contain more fat which may be responsible for adhesions of millet flour around fat. Fermentation showed the lowest BD and TP compared to other treatments this might be the effect of fermentation on complex material which into simpler forms results lower in particle size refracto Moreover, the effect of drying by refracto window dryer on particle size due to phenomena of surface convection and conduction reported to the formation of thin-layer drying. The compression of the pellet due to the granulation method involves the agglomeration of fine particles into larger particles called granules. A similar trend was observed in a decrease in tapped and bulk density with treatment and particle size (Rao *et al*. 2021; Subramanian, Engineering, and 2007 n.d.) [10, 15] Finer the particle size higher the compressibility, this may be due to granules were held together by adhesive forces between the binder (Kumar *et al*. 2013) [3]. Some other factors such as porosity, flow nature and particle size distribution have also an impact on compressibility (Osorio-Fierros *et al*. 2017) [8].

4.3 Effect of premix on compression

The pellet development involves wet granulation, wet granulation consists of three steps which involve wetting, nucleation and growth. In wetting the liquid stabilizer bind in contact with dry flour base while in the case of nucleation distributed particles come in contact to form nuclei granules (Kumar *et al*. 2013) [3]. Growth involves the collision between granules to granules or with equipment. This collision results in breakage of the pellet and less compressibility due to direct impact. Breakage also might be due to other factors as mentioned above bulk density, granular particle size, tapped density, distribution of particle and nature of binder involves. The values of Hausner ratio (H) and Carr's index (CI) showed in fermented sample were 1.37^{a} and 27.45^{a} respectively showing it is flowable compared to raw. Considering roasted, germinated the HR and CI for all the flour was lower in comparison with raw flour. As HR and CI are mainly dependent on BD and TD of the sample, the same could be the reason for the change in HR and CI of flour.

4.4 Water absorption capacity

The WAC measures in terms of the ability of flour to absorb the maximum amount of water reported in table 2. WAC is important to know the hydrophilic and hydrophobic nature of flour mix. Fermented flour showed the significant difference compared other treatments. Roasted flour having higher WAC107.6±6.66^{a} whereas, lower in 69.67±3.21^{a}. The water-loving nature flour shows hydrophilic nature which shows higher WAC. The hydrophilic nature interaction between the water moieties with flour mix through hydrogen bonding. Millet having a high amount of starch from the hydrogen bonding with the water. Starchy biomass and the fibrous nature of millet are responsible for maximum WAC (Suma P and Urooj 2015) [16]. Starch consists of function group either aldehyde or ketone which contain the active sites which able to form hydrogen bonding with water molecules.

4.5 Oil absorption capacity

The OAC was similar to WAC, the ability of the flour to absorb the maximum amount of oil showed in table 2. There was no significant difference among all the treated flour. Higher the OAC were observed in fermented flour 86.33±4.51^{b} while lower in 71.33±2.08^{b} germinated which may be depends on the lipophilic nature of flour mix, oil entrapment in flour occurred to higher the polar nature of protein fragments. The structural changes that occurred during the various germination and fermentation result in protein denaturation and formation of peptide fragments. Germination causes structural changes in protein due to natural enzymes such as alpha-amylase, beta-amylase and protease. However, fermentation microbial strain leads to consumption of starchy biomass leads to the formation of lactic acid results in protein curdling. This evidences concluded that the formation of more a polar nature of amino acid chains and increase in surface polarity resulted in higher lipophilic nature (Suma P and Urooj 2015) [16]. Roasting 73.00±5.20^{b} OAC was enhances compared to due to gelatinization of starch in millet leads to the puffing phenomenon, which causes a more polar nature compared to other germination and fermentation results in lower OAC. Moreover, the raw flour showed the highest OAC due to the presence of various constitutes like antinutritional factors such as tannins, trypsin inhibitor and phytic acid due to their lipophilic nature.

4.6 Water solubility index

The water solubility index represents the water-loving components mainly sugars and soluble fibres. Results showed that there is a significant difference between germinated and fermented treatments. The results observed concluded that the fermented flour composite showed the lowest WSI 3.00±1.00^{c}. However, in roasted 12.67±2.52^{b} and germinated 16.67±1.15^{b} was observed. This may be due to the higher content of soluble fibre and the more hydrophilic nature of components. Besides this various bioactive components like phenolic compounds and flavonoids having water-loving nature. However, compared to raw flour the geminated and roasted flour having more WSI. Germination shows the conversion of higher polysaccharides into soluble sugars through the naturally present enzymes. While in roasting flour gelatinization of starch is responsible for less WSI compared to other treatments. Gelatinization causes the absorption of water results in gel formation leading to the entrapments of the soluble fibres in alpha and beta-amylase and amylose linkages in the gel network.

4.7 Texture analysis

The textual studies of hardness were showed a significant effect among all the treated pellets. The higher hardness of pellet was observed in fermented based pellet 25.93±0.05^{c}, this may be due to the higher flowability nature of flour showed in table 2. The hardness of the raw pellet 15.32±0.01^{a} was lower than all the pellets. Germinated 22.84±0.03^{c} and roasted 17.78±0.04^{b} pellets having more hardness compared to raw. The hardness of pellet depends on the flowing nature of all pellets such as bulk density, tapped density, uniformity and flow behaviour (Quodbach and Kleinebudde 2015) [9].

Table 1: Physicochemical analysis of developed pellet

Sr. No.	Moisture (g/100g)	Protein (g/100g)	Fat (g/100g)	Carbohydrate (g/100g)	Fibre (g/100g)	Ash (g/100g)	Energy value (kcal/100g)
C	0.33±0.01[b]	7.8±0.01[c]	4.6±0.02[a]	73.16±0.03[a]	9.2±0.04[a]	4.91±0.52[b]	365.24±0.01[b]
R	0.18±0.04[d]	8.2±0.04[b]	3.8±0.01[b]	74.40±0.01[a]	8.7±0.02[b]	4.72±0.27[c]	364.60±0.03[a]
G	0.25±0.03[c]	8.4±0.02[b]	3.3±0.03[c]	74.53±0.02[a]	8.5±0.01[b]	5.02±0.34[a]	361.42±0.02[a]
F	0.59±0.3[a]	9.3±0.06[a]	2.3±0.02[d]	75.27±0.01[a]	8.2±0.02[c]	4.34±0.59[d]	358.98±0.01[a]

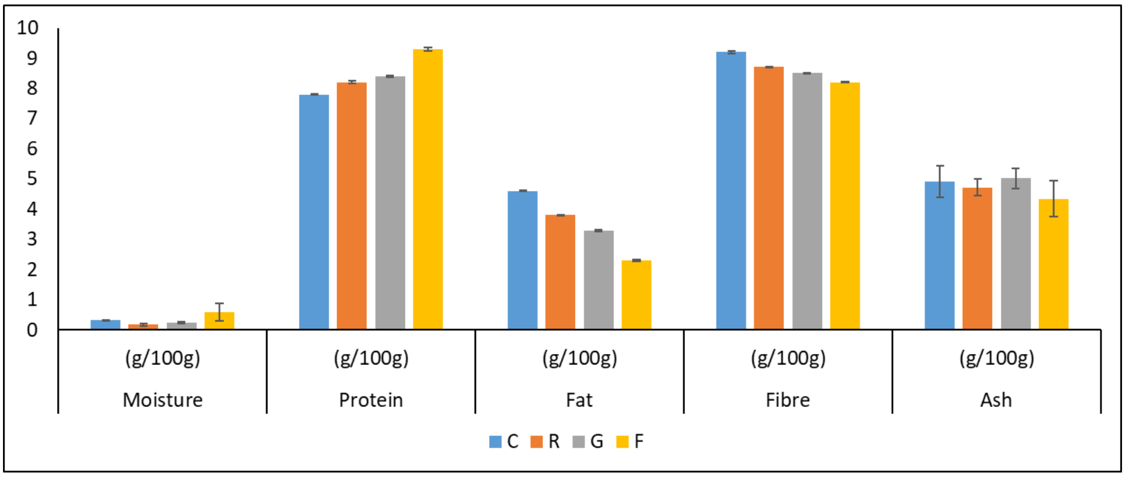

Fig 1: Physicochemical analysis of developed pellet

Table 2: Flow properties of different treated flours

Sr. No.	BD (g/cm3)	TD (g/cm3)	Hausner ratio (H)	Carr's index (CI)	WAC (%)	OAC (%)	WS (%)	Texture (Pa)
C	0.49±0.01[a]	0.69±0.03[a]	1.41[a]	28.99[a]	93.67±2.08[a]	74.00±2.00[a]	11.00±1.00[a]	15.32±0.01[a]
R	0.42±0.02[a]	0.59±0.01[b]	1.40[a]	28.81[a]	107.6±6.66[a]	73.00±5.20[b]	12.67±2.52[b]	17.78±0.04[b]
G	0.48±0.00[b]	0.66±0.02[c]	1.38[a]	27.27[a]	69.67±3.21a	71.33±2.08[b]	16.67±1.15[b]	22.84±0.03[c]
F	0.37±0.02[c]	0.51±0.02[d]	1.37[a]	27.45[a]	97.00±9.85[b]	86.33±4.51[b]	3.00±1.00[c]	25.93±0.05[c]

5. Conclusion

The present study focuses on the flow behavioural properties of different treated composite flour used in the pellet. Further, physicochemical, compositional analysis and textural studies were performed. It is concluded that the fermented and germinated kodo flour premix having higher compressibility with good nutritional content. Furthermore, the study concluded that developed millet-based pellet had a better nutritional profile in terms of protein, lipid and micronutrient content. Thus, fermented probiotic kodo millet-based pellet has better health-promoting potential, protects and improve gut microbiota and may also help to improve immunity. Thus, the future scope of the study should be focused on the use of additives such as colouring and flavours to enhance acceptability.

6. Acknowledgement

The authors acknowledge the facilities provided by Indian an Institute of Food Processing Technology, Thanjavur Tamil Nadu for completion of this study.

7. References

1. Deshpande SS, D Mohapatra MK, Tripathi, Sadvatha RH. "Kodo Millet-Nutritional Value and Utilization in Indian Foods." Journal of Grain Processing and Storage 2015;2(2):16-23. http://jakraya.com/journal/pdf/4-jgpsArticle_1.pdf.
2. Devnani, Bhanu, Lydia Ong, Sandra Kentish, Sally Gras. 2020. "Heat-Induced Denaturation, Aggregation and Gelation of Almond Proteins in Skim and Full Fat Almond Milk." Food Chemistry 325 (September): 126901. https://doi.org/10.1016/J.FOODCHEM.2020.126901.
3. Kumar, Ashish, Krist V Gernaey, Thomas De Beer, and Ingmar Nopens. "Model-Based Analysis of High Shear Wet Granulation from Batch to Continuous Processes in Pharmaceutical Production - A Critical Review." European Journal of Pharmaceutics and Biopharmaceutics. 2013. https://doi.org/10.1016/j.ejpb.2013.09.013.
4. Lestienne, Isabelle, Marie Buisson, Valérie Lullien-Pellerin, Christian Picq, Serge Trèche. "Losses of Nutrients and Anti-Nutritional Factors during Abrasive Decortication of Two Pearl Millet Cultivars (*Pennisetum glaucum*)." Food Chemistry 2007;100(4):1316-23. https://doi.org/10.1016/J.FOODCHEM.2005.11.027.
5. Mohapatra, Asutosh B, Yuvraj, Shanmugasundaram S. "Physicochemical Changes during Ripening of Red Banana." International Journal of Science, Environment and Technology 2016;5(3):1340-48.
6. Nambiar VS, Dhaduk JJ, Sareen N, Shahu T. "Potential Functional Implications of Pearl Millet (*Pennisetum glaucum*) in Health and Disease." Journal of Applied 2011;(10):62-67. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.967.3591&rep=rep1&type=pdf.
7. Official Methods of Analysis, 21st Edition - Aoac International. n.d. "Official Methods of Analysis, 21st Edition 2019." Accessed August 2, 2021. https://www.aoac.org/official-methods-of-analysis-21st-edition-2019/.
8. Osorio-Fierros A, Cronin K, Ring D, Méndez-Zavala A. "Influence of Granulation Process Parameters on Food Tablet Properties Formulated Using Natural Powders

(Opuntia Ficus and Chlorella spp.).” Powder Technology 2017;317:281-86. https://doi.org/10.1016/j.powtec.2017.04.057.
9. Quodbach, Julian, Peter Kleinebudde. “Performance of Tablet Disintegrants: Impact of Storage Conditions and Relative Tablet Density.” Pharmaceutical Development and Technology 2015;20(6):762-68. https://doi.org/10.3109/10837450.2014.920357.
10. Rao MV, KG Akhil, Sunil CK, Venkatachalapathy N. 2021. “Effect of Microwave Treatment on Physical and Functional Properties of Foxtail Millet Flour.” *IJCS*. https://doi.org/10.22271/chemi.2021.v9.i1am.11641.
11. Salleh FS, Mohd YA, Yusof MS, Anuar, Chin NL. “Understanding the Tabletting Characteristics of *Ficus deltoidea* Powder by Fitting into Compression Models.” Journal of Food Process Engineering 2015;38(3):250-61. https://doi.org/10.1111/JFPE.12165.
12. Sharanagat, Vijay Singh, Rajat Suhag, Pulkit Anand, Gaurav Deswal, Rohit Kumar *et al*. “Physico-Functional, Thermo-Pasting and Antioxidant Properties of Microwave Roasted Sorghum [*Sorghum bicolor* (L.) Moench].” Journal of Cereal Science 2019a;85:111-19. https://doi.org/10.1016/J.JCS.2018.11.013.
13. Sharma, Seema, Dharmesh C Saxena, Charanjit Singh Riar. “Antioxidant Activity, Total Phenolics, Flavonoids and Antinutritional Characteristics of Germinated Foxtail Millet (*Setaria italica*).” Cogent Food and Agriculture 2015;1(1). https://doi.org/10.1080/23311932.2015.1081728.
14. Shibata, Keisuke, Dulce M Flores, Genta Kobayashi, Kenji Sonomoto. “Direct L-Lactic Acid Fermentation with Sago Starch by a Novel Amylolytic Lactic Acid Bacterium, *Enterococcus faecium*.” Enzyme and Microbial Technology 2007;41(1-2):149-55. https://doi.org/10.1016/J.ENZMICTEC.2006.12.020.
15. Subramanian S, Viswanathan R. Journal of Food Engineering, and undefined 2007. n.d. “Bulk Density and Friction Coefficients of Selected Minor Millet Grains and Flours.” Elsevier. Accessed October 11, 2021. https://www.sciencedirect.com/science/article/pii/S0260877406006479.
16. Suma P, Florence, Asna Urooj. “Isolation and Characterization of Starch from Pearl Millet (*Pennisetum typhoidium*) Flours.” International Journal of Food Properties 2015;18(12):2675–87. https://doi.org/10.1080/10942912.2014.981640.
17. Taylor, John RN. “Millets: Their Unique Nutritional and Health-Promoting Attributes.” Gluten-Free Ancient Grains: Cereals, Pseudocereals, and Legumes: Sustainable, Nutritious, and Health-Promoting Foods for the 21st Century, 2017, 55-103. https://doi.org/10.1016/B978-0-08-100866-9.00004-2.
18. Theagarajan, Radhika, Lavanya Malur Narayanaswamy, Sayantani Dutta, Jeyan A Moses, Anandharamakrishnan Chinnaswamy. “Valorisation of Grape Pomace (Cv. Muscat) for Development of Functional Cookies.” International Journal of Food Science & Technology 2019;54(4):1299-1305. https://doi.org/10.1111/IJFS.14119.