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Effect of Whey Protein Concentrates (WPC) on Microbial and Textural Evaluation of Foxtail and Finger Millet *Papad*

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A B S T R A C T

Whey Proteins Concentrate (WPC) is an excellent source of dietary nitrogen and branched chain amino acids. Protein Concentrate (WPC) at different levels of substitution i.e. control (T_0), 2.5 parts (T_1), 5 parts (T_2), 7.5 parts (T_3) and 10 parts (T_4). In related to the microbial evaluation of raw foxtail and finger millet *papad* prepared from treatments T_0 to T_4 content, The total plate count, yeast and mold count of all samples of raw foxtail and finger millet *papad* was under acceptable limits. Textural analysis revealed that 10 parts of WPC supplemented foxtail and finger millet fried *papad* showed maximum Hardness (1.84 N) and Fracturability (0.96 mm).

Introduction

Papad is a popular and tasty food item in the Indian diet in many centuries, which is regularly consumed as a meal, accompaniment, after roasting or frying or as adjunct along with vegetable soups and curries (Chowdhury *et al.*, 2009). It is also known as *Appalam* and essentially a thin wafer like product, circular in shape, rolled and nutritious as well.

Millets are important crops of Asia and Africa (especially in India and Nigeria), with 97 percent of millet production in developing countries. Various traditional foods and beverages such as *roti*, bread (fermented or unfermented), porridge, snacks and fast foods, baby foods, millet wine, millet nutrition powder etc. are made up of millets (Chandrasekara and Shahidi, 2012) and it contains 60-70 per cent carbohydrates, 7-11 per cent proteins, 1.5-5 per cent fat, and 2-7 per cent crude fibre and are also rich in vitamins and minerals. They are excellent source of vitamin B, magnesium, and antioxidants (Singh *et al.*, 2012). Millets are also rich sources of micronutrients and phytochemicals (Liu, 2007). It is an alkaline forming food, alkaline based diet is often

recommended to achieve optimal health, meaning when it combines with digestive enzymes. The soothing alkaline nature of millet helps to maintain a healthy pH balance in the body, crucial to prevent illnesses.

Foxtail millet *(Setaria italica)*, a member of the family *Poaceae*, is one of the oldest cereal crops. Foxtail millet grain is rich in protein (12.3%) and iron (2.8mg/100g) as compared to rice (6.8 % protein and 1.8mg iron/100g grain) and rich in fat 4.3 per cent which is superior to rice and wheat. The grain is good source of beta - carotene, which is the precursor of Vitamin A (Murugan and Nirmalakumari 2006). Foxtail millet is mixed with legumes to make porridge and also mixed with soybean to make mixed flour. Foxtail millet has low glycemic index (GI), used for preparation of low GI biscuits and *burfi*, a sweet product and it is an ideal for people suffering from diabetes (Anju and Sarita, 2010) and also fermented to make vinegar, yellow wine, maltose, beer and other related products.

Whey proteins are an excellent source of dietary nitrogen and branched chain amino acids which are used to fuel working muscles and stimulate protein synthesis. Whey protein has antimicrobial, antiviral and antioxidant properties, and they also act as techno-functional ingredients in many formulated food systems due to their good solubility, surface activity and gelling properties. In addition, whey proteins and their associated peptides display significant functional food ingredient potential (Chatterjee and Kanawjia, 2010).

Materials and Methods

Millet grains

Minor millets such as foxtail millet (DHF-1) and finger millet (CO-9) are procured from the Indian Institute of Millet Research (IIMR), Rajendranagar, Hyderabad.

Whey Protein Concentrate (WPC)

Whey Protein Concentrate (WPC-70) required for study was purchased from Modern dairy limited, Karnal.

Ingredients

Salt, alkaline salt (*papad* khar), red chilly powder, cumin, sesamum, asafoetida and fortune soybean oil was procured from the local market of Parbhani (Table 1 and 2).

Chemicals and glassware's

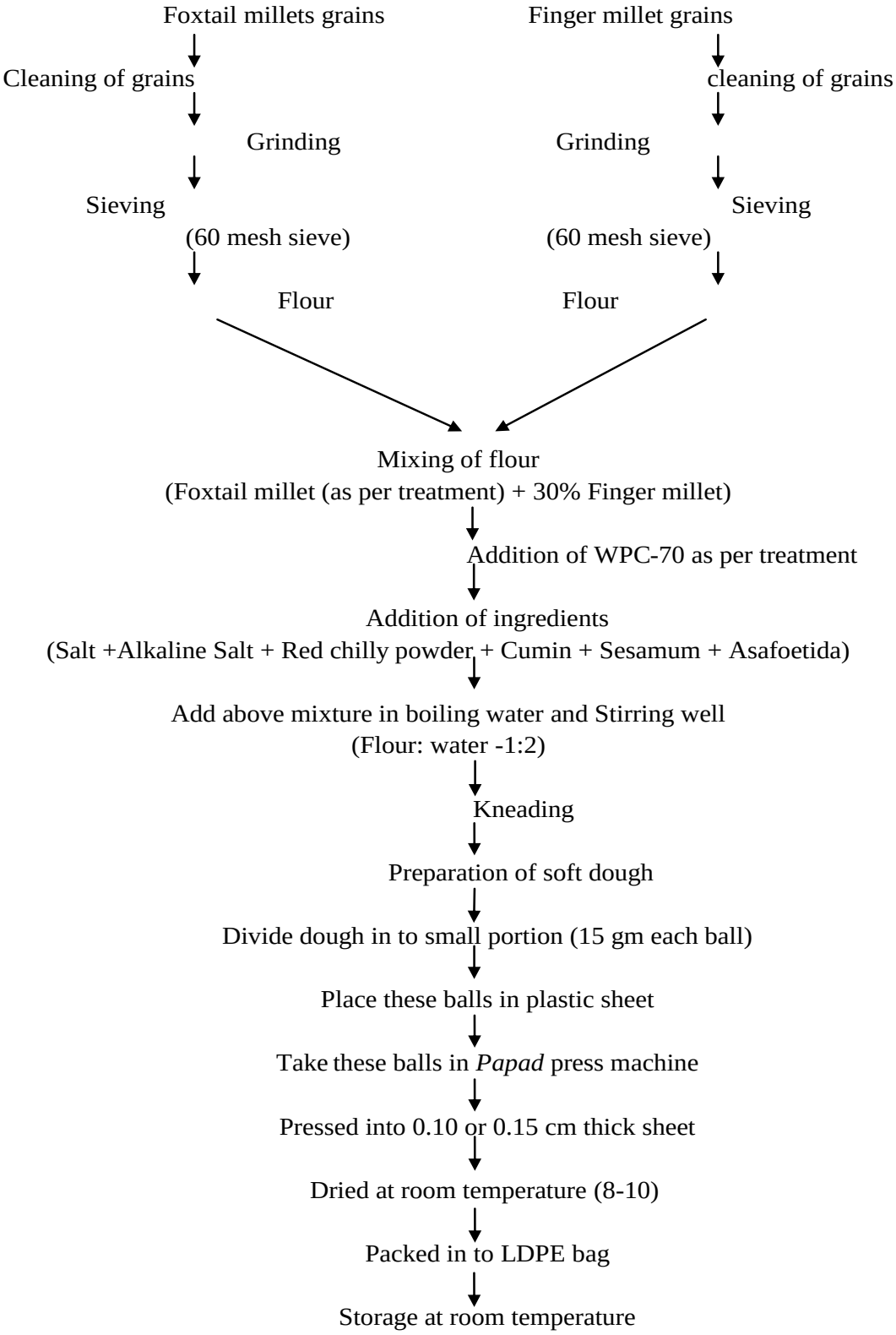
Chemicals (Analytical grade) were procured from standard firms and glassware's required for conducting chemicals analysis and preparation of product utilized from laboratory of department of AHDS, VNMKV, Parbhani.

Treatment details

During this *papad* preparation two minor millets viz. Foxtail millet (DHF-1) and Finger millet (CO-9) were utilized with WPC.

T_0 – 70 parts Foxtail millets + 30 parts finger millet
T_1 – 67.5 parts of Foxtail millets + 30 parts finger millet + 2.5 parts of WPC
T_2 – 65.0 parts of Foxtail millets + 30 parts finger millet + 5.0 parts of WPC
T_3 – 62.5 parts of Foxtail millets + 30 parts finger millet +7.5 parts of WPC
T_4 – 60.0 parts of Foxtail millets + 30 parts finger millet +10.0 parts of WPC

Flow diagram for preparation of protein enriched foxtail and finger millet *Papad*



Preparation of protein enriched foxtail millet and finger millet *papad*

Methodology

Microbiology of *Papad*

All samples were analyzed for different microbial counts such as total plate count and yeast and mold count by adopting standard procedures.

Total plate count

The total plate count of protein enriched foxtail and finger millet *papad* was determined by using total plate count method using Nutrient Agar. The dilution where made up to 10^{-6} and the 1 ml of aliquot was used for the isolation. All processes were carried out in a sterile area with the help of laminar air flow. Plate was incubated at 37^0 C for 48 hr. and results noted in CFU/ml. Total plate count (TPC) of *papad* were examined at 1 to 6 months (Chandru *et al.*, 2010).

Yeast and mould count

Yeast and mould count was determined by the method cited in ISI (IS: 5403) 1969 using potato glucose agar up to 1 to 6 months.

Textural characteristics of *Papad*

Stable Micro System *TAXT2 plus* Texture Analyzer was used for texture profile analysis (TPA) of protein enriched minor millet *papad* prepared by lab sample. A spherical-end probe of 6.35 mm of diameter with test speed of 1 mm/sec. of pre-test and post-test speeds; and 50 % compression was taken for TPA analysis. TPA is "two-bite" test, which includes the first and second compression cycles. The first and second compression cycles indicate the force vs. time data during the first and second compression of the product by the instrument probe. There were two replications of the instrumental analysis conducted on two separate days. For each replication, minor millet *papad* incorporated with different proportions of WPC were evaluated.

Statistical analysis

The data obtained was analysed using Completely Randomize Design (Panse and Sukhatme, 1985).

Results and Discussion

Effect of WPC on microbial qualities of finger millet raw *Papad*

It is revealed from table 3 that after 30 days of storage total plate count was found in T_3 and T_4 and not detected in rest of treatments. After 60 days of storage the TPC was increased from T_2 (0.58×10^2 CFU/g). From Table 3, it can be concluded that after 90 days of storage the samples of foxtail and finger millet *papad* with 10 pars of WPC supplemented (T_4) tend to have higher mean Total plate counts than those with T_3, T_2, T_1 and T_0. The maximum Total plate count on nutrient agar was observed in T_4 (10 parts WPC supplemented *papad*) and minimum in T_0 (control) for 90, 120, 150 and 180 days of storage period. Results revealed that the total plate count of all samples does not differ significantly. The increase in microbial load of WPC supplemented foxtail and finger millet *papad* as compared to control may be due to increase in moisture content with increasing WPC supplementation level. The growths of TPC were in increasing order as storage period increased. As per the WHO (1994) guidelines the total plate count should be less than 2 x 10^5 per gram. The result of this study in respect of TPC was in acceptable limit.

From table 4, it was observed that the yeast and mould growth was not detectable up to 30 days of storage in all treatments and after 60 days of storage yeast and mould count was

observed only in treatment T_4 (0.65×10^2 CFU/g). After 90 days of storage yeast and mould count was observed in T_2, T_3 and T_4 and absent in T_0 and T_1. After 120 days of storage the samples of foxtail and finger millet *papad* with 10 parts of WPC supplemented (T_4) tend to have higher mean yeast and mould counts than those with T_3, T_2, T_1 and T_0. The maximum yeast and mould count was observed in T_4 (10 pars WPC supplemented *papad*) and minimum in T_0 (control) for 120, 150 and 180 days of storage. Results of this study revealed that the yeast and mould count of all samples does not differ significantly. The increase in yeast and mould count of WPC supplemented millet *papad* as compared to control may be due to increase in moisture content with increasing WPC supplementation level. As per the WHO (1994) guideline the Yeast and mold count should be less than 1×10^4 per gram. Above results related to yeast and mould count was within the acceptable limit.

Maximum hardness was observed for foxtail and finger millet fried *papad* prepared using 10 parts of WPC (1.84 N) and minimum (1.61N) for foxtail and finger millet fried *papad* prepared by without addition of WPC. Hardness of foxtail and finger millet fried *papad* in peak positive force was increases as the incorporation of WPC increases from 0 to 10 parts. Variation in hardness of protein enriched foxtail and finger millet fried *papad* samples might be due to protein content; it hold recipe water and binds other ingredients and increases the breaking strength or hardness of the product. Present results are in agreement with Wani *et al.,* (2015) indicated that, the highest peak force was observed in 6 (%) WPC supplemented cookies (55.3 N), followed by control cookies (50.2 N). Fracturability of foxtail and finger millet fried *papad* was ranged from 0.76 to 0.96 mm. Fracturability of fried *papad* increased as the incorporation of WPC increases from 0 to 10 parts. It is may be due to the increasing hardness of developed product. The fracturability of the foxtail and finger millet fried *papad* with 10 parts WPC (T_4) was significantly ($P<0.05$) superior over all treatments.

Table.1 Recipe for preparation of protein enriched minor millet *Papad*

Sr. No	Ingredients	Quantity for 100 gm
1	Salt	2 gm
2	Alkaline Salt (*Papadkhar*)	3 gm
3	Red chilly powder	1 gm
4	Cumin	1.5 gm
5	Sesamum	2 gm
6	Asafoetida	0.5 gm
7	Water	200 - 220 ml
8	WPC- 70	As per treatment combinations

Table.2 Chemical composition of WPC, foxtail and finger millet grains

Sr. no	Composition	WPC Powder	Foxtail millet Grains	Finger millet Grains
1	Total Solid (%)	96.96	91.95	90.10
2	Ash (%)	6.20	1.09	2.40
3	Moisture (%)	3.04	9.42	9.50
4	Protein (%)	70.85	13.0	8.80
5	Fat (%)	6.50	3.67	3.90
6	Carbohydrate (%)	-	74.19	75.00
7	NPN (%)	0.18	-	-
8	Calcium (%)	1.70	-	-
9	Chloride (%)	1.57	-	-
10	Acidity (%)	1.62	-	-

(Rathour *et al.*, 2016; Nazni and Bhuvaneshwari, 2015; Kamtkar *et al.*, 2015)

Table.3 Effect of WPC on total plate count ($\times 10^2$ CFU/g) of foxtail and finger millet raw *papad*

Treatment	Storage period in days ($\times 10^2$ CFU/g)						
	00	30	60	90	120	150	180
T_0	ND	ND	ND	0.45	1.00	1.75	2.50
T_1	ND	ND	ND	0.64	1.20	2.75	3.75
T_2	ND	ND	0.58	0.90	1.75	3.20	4.65
T_3	ND	0.65	0.82	1.50	2.50	4.50	5.75
T_4	ND	0.85	1.20	2.50	3.75	5.50	6.75
SE	**0.00**	**0.09**	**0.05**	**0.04**	**0.05**	**0.05**	**0.03**
CD at 5%	**0.00**	**0.27**	**0.15**	**0.12**	**0.15**	**0.15**	**0.09**

Table.4 Effect of WPC on yeast and mould count ($\times 10^2$ CFU/g) of raw foxtail and finger millet *papad*

Treatment	Storage period in days ($\times 10^2$ CFU/g)						
	00	30	60	90	120	150	180
T_0	ND	ND	ND	ND	0.25	0.75	1.25
T_1	ND	ND	ND	ND	0.45	1.20	1.75
T_2	ND	ND	ND	0.25	0.75	1.75	2.50
T_3	ND	ND	ND	0.75	1.25	2.50	3.15
T_4	ND	ND	0.65	1.25	2.00	2.75	3.95
SE	**0.00**	**0.00**	**0.01**	**0.03**	**0.03**	**0.07**	**0.06**
CD at 5%	**0.00**	**0.00**	**0.03**	**0.09**	**0.10**	**0.21**	**0.18**

Table.5 Effect of WPC on textural properties of foxtail and finger millet fried *Papad*

Treatments	Hardness (N)	Fracturability (mm)
T_0	1.61^a	0.76^a
T_1	1.67^b	0.82^b
T_2	1.72^c	0.87^c
T_3	1.77^d	0.92^d
T_4	1.84^e	0.96^e
SE	**0.01**	**0.01**
CD at 5%	**0.03**	**0.03**

Hence concluded, in view of experimental results obtained during the present investigation, as supplementation of WPC increases microbial quality such as TPC and yeast and mold increased in foxtail and finger millet *papad*. The TPC and Yeast and mold count in all samples for period of six months was found within acceptable limits. WPC supplementation affected textural characteristic of fried *Papad*, the hardness and fracturability increases with increase in the WPC level.

References

Anju, T and Sarita, S. 2010. Suitability of Foxtail Millet *(Setaria ITALICA)* and Barnyard Millet *(Echinochloa frumentacea)* for Development of Low Glycemic Index Biscuits. *Malays Journal of Nutrition*, 16(3): 361-368.

Chandrasekara, A. and Shahidi, F. 2012. Bioaccessibility and Antioxidant Potential of Millet Grain Phenolics as Affected by Simulated in Vitro Digestion and Microbial Fermentation. *Journal of Functional Foods*, 4: 226-237.

Chatterjee, A. and Kanawjia, S. K. 2010. Whey Proteins for Healthy Living. *Indian Dairyman*, 66-73.

Chowdhury, M.G.F., Miaruddin, M., Rahman, M. M., Islam M.S. and Tariqul Islam A.F. 2009. Study on the Effect of Preservative on the Storage Quality of Spiced *Papad*s. *Journal of Innovation and Development Strategy*, 3(1): 30-33.

Garg, R. and Dahiya, S. 2003. Nutritional Evaluation and Shelf Life Studies of *Papad*s Prepared from Wheat Legume Composite Flours. *Plants Foods for Human Nutrition*, 58 (4): 299-307.

Haupt, M. F., Mckee, D. M., Mayers, G. and Pollina, L. K. 1997. Fortification of Corn bread with Lysine. *Journal of American Dietetic Association*. 97: A83-A88.

Kamatar, M. Y., Brunda, S. M., Rajaput, S, Sowmya, H. H. and Goaudhar, G. 2015. Nutritional Composition of Seventy Five Elite Germplasm of Foxtail Millet *(Setaria italica). International Journal of Engineering and Technical Research*, 4(4):1-6.

Liu, R.H. 2007. Whole Grain Phytochemicals and Health. *Journal of Cereal Science*, 46(3): 207-219.

Murugan R and Nirmalkumari A .2006. Genetic Divergence in Foxtail Millet (*Setaria italica* (L.) Beauv). *Indian Journal of Genetics*. 66(4): 339-340.

Nazni and Bhuvaneshwari. 2015. Analysis of Physico Chemical and Functional Characteristics of Finger Millet (*Eleusine corcana L*) and Little Millet *(Panicum sumantarnce). International Journal of Food and Nutritional Sciences*, 4(3): 109-114.

Panse, Y. P. and Sukatme, P. V. 1961. Statistical Methods for Agricultural

Workers, 2nd edn. Indian Council of Agricultural Research, New Delhi.

Rathour, A. K., Rathore, V., Mehta, B. M., Patel, S. M., Chauhan, A. and Aparnathi, K. D. 2016. Standardization and Storage Study of Whey Protein Concentrate (WPC-70) Prepared From Buffalo Milk Using Ultrafiltration Membrane Technology. *Journal of Food Processing and Preservation*. 41: 1-8.

Singh, K. P., Mishra, A, Mishra, H. N 2012. Fuzzy Analysis of Sensory Attributes of Bread Prepared from Millet-Based Composite Flours. *LWT-Food Science and Technology*, 48(2): 276-82.

Vedprakash, D. and Madhavareddy, R. 2018. Studies on Traditional Indian Fermented food: Characterization and Development of Jowar *papad*. *Int. J. Curr. Microbiol. App. Sci*. 6: 866-882.

Wani, S. H., Gull, A., Allaie, F. and Safapuri, T. A. 2015. Effects of Incorporation of Whey Protein Concentrate on Physicochemical, Texture, and Microbial Evaluation of Developed Cookies. *Cogent Food and Agriculture*: 1-9.

WHO (World Health Organization) 2011. Vitamin A supplementation in infants and children 6 to 9 months of age. www.worldfoodprize.org.

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