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Effect of pH Variation on Solubility of Seed Protein of hybrid Varieties of Minor Millet Seeds.

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ABSTRACT

Minor millets are a major food source in arid and semi-arid parts of the world. Millets are good sources of energy and protein. The effect of pH variation (ranging from 0.5-13.5) on the solubility of seed protein of nine hybrid varieties of minor millet seeds viz., Eleusine coracana(variety DFM-1 & HR-374), Paspalum scrobiculatum (variety JK-41, JK-48 & JK-439), Panicum sumatrnse (variety JK- 8 & LMCO-2), Echinochloa frumentacea (variety BMVL-29 & BMVL-172). All the nine varieties exhibited characteristic curves towards maximum solubility at 12.0 pH.

Keywords: Protein Solubility, pH value, minor millet seeds, varieties of Eleusine coracana, Paspalum scrobiculatum, Panicum sumatrnse, Echinochloa frumentacea.

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INTRODUCTION

Millets are significant as food crops in their respective agro-ecosystem. They play an important role and provide food security in times of drought and other natural challenges. Functional properties are important criteria while people developing new proteinicious products [1].The use of seed protein by the food industries has been increased tremendously and studies on above aspects in the form of research towards utilization of seed as protein in food. Seed proteins improvement as an ingredient primarily to increase nutritional quality having desirable attributes for structure, texture, flavour and colour are characteristics in formulated food products. The knowledge of protein structure and size amongst different varieties of minor millet seeds will help the understanding of the protein properties. This will help to formulate strategy in favour of permission and manipulation of these properties for development of food products.

Nutritional and functional qualities of protein are largely determined by its amino acid content and solubility of nitrogen. Nitrogen solubility is one of important aspects of hydration in evaluation of protein quality, since many functional properties of protein depend upon their capacity to go into solution initially. Solubility may be affected by many factors such as pH during extraction or solubilization, size of meal particle, temperature and meal solvent ratio, composition of solvent and character of protein [2-8].

Present study aims to determine the solubility behavior of seed proteins for minor millets seed at different pH that may help in future formulation of food product. The understanding of functional properties of seed protein and their successful extraction and purification in large quantities the study will also help in calibration of additives in the cereal diets of food product commonly marketed as supplementary protein to enrich their nutritive value.

MATERIALS AND METHODS

New hybrid, authentic, healthy and matured seeds of minor millets variety Eleusine coracana(variety DFM-1 & HR-374), Paspalum scrobiculatum (variety JK-41,JK-48 & JK-439), Panicum sumatrense (variety JK- 8 & LMCO-2), Echinochloa frumentacea *(*variety BMVL-29 & BMVL-172) under investigation were procured from Agriculture Research Station Dindori, regional extension of Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur (M.P.)

In the present investigation the seeds of minor millet were analyzed for their protein content and protein solubilization with pH variation in the powdered form, because size of seed powder has been shown to influence the nitrogenous extraction [9-10]. The seeds were sun dried and powdered to 60 mesh [11].

The effect of pH variation of the extractant on the protein solubilization were studied by varying pH of water, ranging from 0.5 to 13.5, brought by addition of hydrochloric acid or sodium hydroxide solution. One gram of seed powder was suspended in 20 mL of extractant of desired pH. The contents were shaken in electrical shaker for about 2 h at room temperature and centrifuge for 20 min at 2000 rpm in a centrifuge. The nitrogen solubilized was determined in supernatant so obtained by Semi Micro Kjeldahl method [12].

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RESULTS AND DISCUSSION

The seeds of Eleusine coracana (variety DFM-1 & HR-374),Paspalum scrobiculatum (variety JK-41,JK-48 & JK-439), Panicum sumatrense (variety JK- 8 & LMCO-2), Echinochloa frumentacea *(*variety BMVL-29 & BMVL-172) were studied for their protein solubility behaviors in considerable wide pH range from 0.5 to 13.5 .The results of protein solubility are given in Table 1.

Table 1 The Effect of ph Variation on The Solubility of Seed Proteins of Minor Millets

pH Value	*Eleusine coracana DFM-1*	*Eleusine coracana* HR-374	Paspalum scrobiculam JK-41	Paspalum scrobiculatm JK-48	Paspalum scrobiculatum JK-439	Panicum sumatrense JK-8	Panicum sumatrense LMCO-2	Echinochloa frumentacea BMVL-29	Echinochloa frumentacea BMVL-172
0.5	4.125	3.535	2.333	2.703	2.153	3.791	3.332	3.750	3.897
1.0	3.425	2.835	2.723	3.093	2.543	4.662	4.200	4.622	4.678
1.5	4.485	3.895	2.68	3.050	2.50	5.255	4.794	5.212	5.271
2.0	1.385	0.795	2.255	2.623	2.124	2.192	1.732	2.154	2.220
2.5	1.405	1.242	1.063	1.433	1.242	1.230	1.772	1.190	1.271
3.0	2.835	2.245	1.766	2.136	1.586	3.391	2.939	3.353	3.455
3.5	1.425	1.242	1.355	1.725	1.175	2.400	1.945	2.365	2.423
4.0	3.105	2.515	3.015	3.385	2.835	3.060	2.642	3.023	3.867
4.5	2.782	2.191	1.225	1.595	1.506	1.666	1.234	1.622	1.690
5.0	1.731	1.144	1.806	2.176	2.626	3.180	2.725	3.143	3.200
5.5	3.125	2.535	2.01	2.028	2.475	3.001	3.948	2.978	3.040
6.0	1.925	1.335	1.166	1.536	1.098	1.244	1.234	1.200	1.253
6.5	2.482	1.890	2.100	2.140	2.159	2.400	1.945	2.367	2.423
7.0	3.525	2.935	2.642	2.545	1.995	4.942	4.484	4.900	4.960
7.5	4.00	3.411	2.146	2.015	1.465	3.678	3.212	3.633	3.687
8.0	2.272	1.688	1.04	1.004	1.009	1.230	1.700	1.190	1.322
8.5	1.405	0.815	0.125	0.495	0.040	1.265	1.750	1.220	1.287
9.0	4.225	3.635	4.035	4.405	3.90	5.112	4.650	5.071	5.255
9.5	2.255	1.665	1.815	2.185	1.635	1.653	1.198	1.611	1.689
10.0	4.00	3.411	2.11	2.48	1.93	4.487	4.026	4.440	4.490
10.5	1.9155	1.325	3.78	4.15	3.63	2.333	1.870	2.291	2.355
11.0	4.221	3.63	3.78	4.15	3.63	1.656	1.198	1.610	1.689
11.5	3.455	2.865	3.355	3.725	3.175	3.678	3.189	3.633	3.687
12.0	6.950	6.362	6.395	6.765	6.215	6.297	5.860	6.254	6.300
12.5	4.841	4.25	4.68	5.055	4.505	5.390	4.936	5.355	5.423
13.0	2.451	2.32	2.395	2.765	2.215	2.632	2.174	2.685	2.657
13.5	3.441	3.00	3.085	3.455	2.905	2.832	2.372	2.786	2.790

* The values given in the tables are the mean of the triplicate values obtained.

The determination of percent of total proteins (12.25 percent) of Eleusine coracana variety DFM-1 solublized showed the maximum solubility (6.95 percent) at pH 12.0, while it was minimum (1.39 percent) at pH 2.0. At the remaining pH, solubility of the proteins was found to fluctuate between 1.405-4.84 percent.

The solubility of total seed proteins (11.66 percent) of Eleusine coracana variety HR-374 was found to be maximum (6.36 percent) at pH 12.0 and it was observed to be minimum (0.795 percent) at pH 2.0. The solubility of the proteins was found to fluctuate between 1.14-4.25percent at the remaining pH.

The determination of percent of total proteins (9.83 percent) of Paspalum scrobiculatum variety JK-41 solubilized showed the maximum solubility of 6.39 percent at

pH 12.0 while it was minimum (0.125 percent) at pH 8.5. At the remaining pH, solubility of the proteins was found to vary in between 1.04-4.68 percent.

The percentage of total proteins (10.2percent) of Paspalum scrobiculatum JK-48, solubility was found to be maximum (6.76 percent) at pH 12.0 while it was minimum (0.49 percent) at pH 8.5. At the remaining pH, solubility of the proteins was found to fluctuate between 1.0- 5.05 percent.

The solubility of total seed proteins (9.65 percent) of Paspalum scrobiculatum variety JK-439 was found to be maximum (6.215 percent) at pH 12.0 and minimum (0.04 percent) at pH 8.5. At the remaining pH, solubility of the proteins was found to vary between 1.0-4.50 percent.

In the case of Panicum sumatrense JK-8 at pH 12.0 solubility was found to be maximum (6.29 percent) while it was reported minimum (1.23 percent) at 2.5 and 8.0 pH of total seed proteins (11.91percent). At the remaining pH, solubility of the proteins was found to fluctuate between 1.24- 5.39percent.

The determination of percent of total proteins (11.45 percent) of Panicum sumatrense variety LMCO-2 solubilized showed the maximum solubility of 5.86 percent at pH 12.0 while it was observed minimum (1.19 percent) at 9.5 and 11.0 pH. At the remaining pH, solubility of the proteins was found to vary in between 1.23-4.93 percent.

The maximum (6.25 percent) seed protein of Echinochloa frumentacea BMVL-29 was extracted at pH 12.0, while minimum (1.19 percent) extraction was observed at 2.5 and 8.0 pH of total seed proteins (11.87percent). At the remaining pH, solubility of the proteins was found to fluctuate between 1.20- 5.35percent.

The highest (6.30 percent) seed protein of Echinochloa frumentacea BMVL-172 was extracted at pH 12.0 while lowest (1.25 percent) extraction was observed at 6.0 pH of total seed proteins (12.0 percent). At the remaining pH, solubility of the proteins was found to fluctuate between 1.27- 5.42 percent

It was found that alkaline medium was more effective in extraction of protein from minor millets. As the acidity increased, solubility drastically reduced rapidly and minimum is observed. This is isoelectric region.

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