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Influence of Water solubility Index and Water absorption index of millet pasta

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Abstract: An attempt was made to develop a millet based pasta by replacing durum wheat semolina (DWS) with a combination of sorghum flour (SF) and pearl millet flour (PMF) (50:50) at different ratios of blend i.e., 100:0, 75:25, 50:50 and 25:75. The developed millet based pasta from various levels were subjected for water solubility index (WSI) and water absorption index (WAI). It was interesting to record that the as the levels of millets (sorghum flour and pearl millet flour) increased there was notable decrease in the water solubility index. Conversely, the WAI increased significantly as the proportion of millets (sorghum flour and pearl millet flour) increased in the admixture.

Keywords: Water solubility index, Water absorption index, Sorghum flour, pearl millet flour, durum wheat semolina

I. INTRODUCTION

The water solubility index aids as an indicator of degradation of molecular components. The WSI measures, amount of soluble polysaccharide released from the starch component after extrusion. WSI is used as a measure for starch degradation (Manjula and Visvanathan, 2014).

Water Absorptive Index (WAI) is an index of swelling behaviour of starch component and is indicative of hydrolytic breakdown of starch as well as protein denaturation and complex macro molecular formulation. The difference in WAI and WSI may be due to the hydrophilic polysaccharides present in their respective flour (Oninawo and Asugo, 2004).

The present study aims at determining the WSI and WAI of the millet based pasta prepared by the admixtures of durum wheat semolina, sorghum flour and pearl millet flour (50:50) at various levels of blends 100:0, 75:25, 50:50 and 25:75 in order, to study the effect of Water solubility Index and Water absorption index of the extrudates.

II. MATERIALS AND METHODS

The millet based pasta prepared as per Pagani et al, (1989) from sorghum flour and Peral millet flour (50:50) by replacing durum wheat semolina at 100:0, 75:25, 50:50 and 25:75 different proportions of admixture. The known quantity water is used for mixing and kneading in to a dough and is extruded through a single screw extruder and the obtained extrudate was dried at a known temperature for a known duration of time and the obtained dried millet based pasta at 0, 25,50 and 75 were determined for WSI and WAI.

Water Solubility Index (WSI)

Water Solubility Index (WSI) was determined by the method of Anderson (1982 a) 2.5 g sample was dispersed in 25 g distilled water, using a glass rod to break up any lumps and then stirred for 30 min. The dispersions were transferred into centrifuge tubes, made up to 32.5 g and then centrifuged at 4000 rpm for 15 min. The supernatant was decanted for determination of its solid content and sediment was weighed. WSI was calculated as

$$\text{Water Solubility Index (\%)} = \left[\frac{\text{Weight of dissolved solids in supernatant (g)}}{\text{Weight of dry solids (g)}}\right] \times 100$$

Water Absorption Index (WAI)

Water absorption index (WAI) was determined by the method of Anderson (1982a) described as above. WAI calculated as

WAI = Weight of sediment (g) / Weight of dry solids (g)

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Statistical Analysis

The data obtained in the process of product optimization was analysed using one -way or Two-way ANOVA by using R-software

III. RESULTS AND DISCUSSION

Effect of replacement of durum wheat semolina with the combination of sorghum flour (SF) and pearl millet flour (PMF) (50:50) on the Water Solubility Index (WSI) and Water Absorption Index (WAI) of pasta

The result pertaining to the effect of replacement of DWS with the combination of sorghum flour (SF) and pearl millet flour (PMF) (50:50) on WSI and WAI of pasta is presented in Table 1.

As the level of sorghum flour and pearl millet flour (50:50) increased in the admixture from 0 to 75 per cent a significant decrease ($P<0.05$) in the water solubility index was observed in the pasta. The water solubility index was noted to be 14.00, 12.79, 11.79 and 9.90 at 0, 25, 50 and 75 per cent replacement levels respectively. Conversely, the water absorption index increased significantly ($P<0.05$) as the proportion of SF+PMF increased in the admixture was 10.00, 17.46, 23.24 and 36.17 at 0, 25, 50 and 75 per cent replacement of DWS flour, respectively.

Table 1. Effect of replacement of durum wheat semolina with the combination of sorghum flour (SF) and pearl millet flour (PMF) on the Water Solubility Index (WSI) and Water Absorption Index (WAI) of pasta

Ratio of blend (DWS:SF+PMF)	WSI (%)	WAI (gm)
100:0	$14.00^{d}\pm0.01$	$10.00^{a}\pm0.02$
75:25	$12.79^{c}\pm0.02$	$17.46^{b}\pm0.05$
50:50	$11.79^{b}\pm0.03$	$23.24^{c}\pm0.06$
25:75	$9.90^{a}\pm0.02$	$36.17^{d}\pm0.04$

Note: The means with different superscripts within the column differ significantly at ($P<0.05$)
The critical differences were obtained based on the ratio scale ($P<0.05$)
DWS: SF+ PMF -Durum wheat semolina: Sorghum flour +Pearl millet flour

Pasta characteristics as affected by the levels of replacement of durum wheat semolina with the admixture of sorghum flour and pearl millet flour (50:50) as measured in terms of water solubility index and water absorption index is tabulated in Table 1.

The water solubility index of pasta decreased with increasing levels of sorghum and pearl millet flour in the admixture whereas, the water absorption index increased with increasing levels of sorghum and pearl millet flour in the preparation of pasta.

The WSI and WAI are inversely proportional. The increased water absorption index and decrease in water solubility index of pasta could be ascribed to the lower gluten content of sorghum as well as pearl millet flour as compared to durum wheat semolina. Water solubility index values were 14.00, 12.79, 11.79 and 9.90 whereas, water absorption index were observed to be 10.00, 17.46, 23.24 and 36.17 respectively at the replacement level of 0, 25, 50 and 75 per cent.

Kamble *et al*. (2019) developed multi-grain pasta. consisting of sorghum flour (20%–35%), finger millet flour (10%–25%) and gluten (3%–5%). The optimized pasta was made from sorghum (31.96%) and finger millet (13.04%) along with gluten incorporation (3.40%) had a significant positive effect on the overall acceptability of pasta as well. Such product was also determined for Water absorption index WAI = 119.54 ± 2.54%, whereas, the predicted values were 121.46.

Kaur *et al*. (2020) studied the characterization of extruded products from millets-legumes and it was found that Sorghum and mungbean (90%+10%) gives highest WAI (5.290g/g) and (70%+30%) had the lowest value (3.68g/g) WAI values did not have any significant difference for both Sorghum and Mung bean samples as well as Pearl millet and Mung bean samples.

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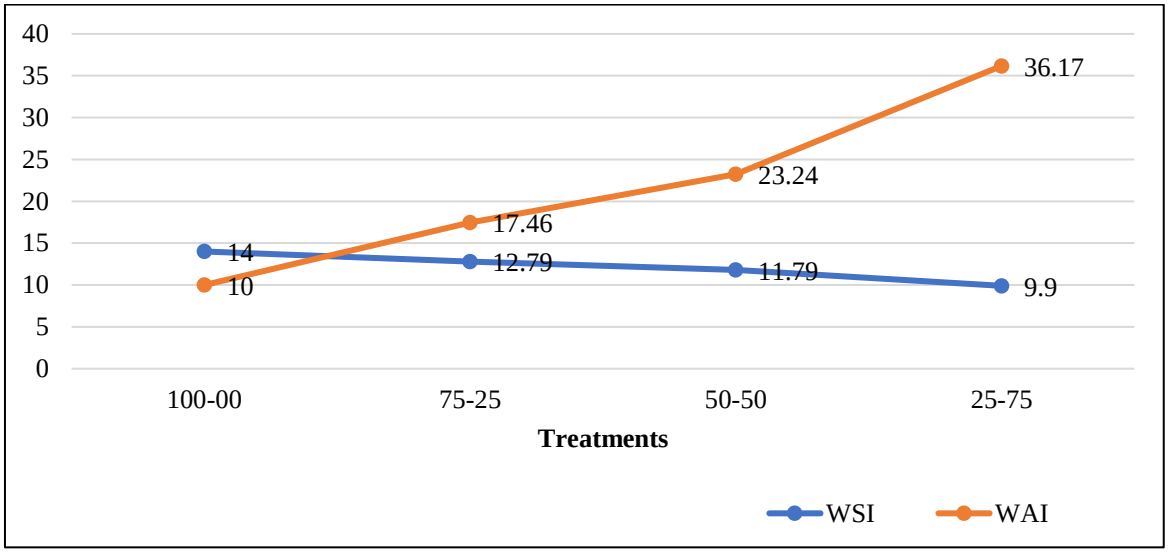

The effect of replacement of durum wheat semolina with the combination of sorghum flour (SF) and pearl millet flour (PMF) on the Water Solubility Index (WSI) and Water Absorption Index (WAI) of pasta

IV. CONCLUSION

The WSI and WAI of the millet based pasta prepared from the admixtures of sorghum flour and pearl millet flour by replacing durum wheat semolina at 100:0 admixture (DWS:SF+PMF) was 14.00 per cent and 10 g whereas, at 50:50 admixture (DWS:SF+PMF) it was noted to be 11.79 per cent and 23.24 g. thus, results indicate that the WSI decreases with increasing levels of sorghum and pearl millet flours whereas, the water absorption index increased with the increasing levels of millet flours.

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