

Development and Nutrient Evaluation of Oat Supplemented Products for Old Aged People with Constipation

Vidisha Sharma and Paramjit Chawla

Department of Food and Nutrition, PAU, Ludhiana, Punjab, India

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ABSTRACT Constipation refers to bowel movements that are infrequent. Severe constipation includes obstipation and faecal impaction found very commonly in old aged. The first step to treat constipation is by increasing the intake of dietary fibre. Oats can be supplemented in a normal carbohydrate meal without the loss of taste, palatability. Supplementary product samples of sweet *dalia*, salty *dalia* and *khichdi* were prepared using broken wheat and rice as control while for test samples broken wheat for both sweet and salty *dalia* and rice were supplemented with oats at 20 percent, 25 percent and 30 percent levels. The control and the most acceptable level of oat supplementation in the products were analysed for proximate composition (moisture, crude protein, crude fat, crude fibre, total ash) carbohydrates and energy were calculated. Fibre fractions namely NDF, ADF and lignin were also estimated. Taste of salty *dalia* supplemented with 25 percent scored the best score of 8.0 while all the sensory parameters of sweet *dalia* supplemented with oats at same percentage had the highest scores. Addition of oats at 25 percent level in sweet/salty *dalia* and *khichdi* increased the moisture, crude protein and crude fibre value. While the fibre fractions of NDF, ADF and lignin also increased in the supplemented products.

INTRODUCTION

Constipation is highly prevalent and bothersome disorder that negatively affects mostly old aged people. An accurate determination of the prevalence of constipation is difficult but many epidemiological studies have shown that this affects about 20 percent of the population at any one time (Lam Kai 2005). Constipation, if not managed proactively can cause negative effects such as anorexia, nausea, bowel impaction or bowel perforation. The first step in the treatment of constipation includes increased intake of dietary fibre. Supplementing the diet with high fibre foods like oats brings upon marked improvement in bowel frequency. Valle-Jones (1985) reported that supplementation of biscuits with 35 percent oats to elderly twice a day for a period of 12 weeks improves the stool consistency and reduces any pain on defecation. There is a considerable range of treatment modalities available for constipation but with the inclusion of plant products like oats the occurrence can be reduced. Oats contain beta glucan 55 percent which is soluble fibre and 45 percent of insoluble fibre. Due to poor absorbability insoluble fibres improve faecal bulk, laxation and ameliorate constipation (Bell et al. 2009). These reduce the transit time and help in treating constipation. Oats can be supplemented in a normal carbohydrate meal without the loss of taste, palatability and their action of decreasing the transit time helps in both treating and preventing constipation.

Apart from this, antioxidant compounds found in oats called avenanthramides help in preventing free radical damage and thus reducing the risk of cardiac diseases. Oats also contain many powerful phytochemicals, phenolics and ligans which are converted to enterolactone in our intestines and protect against heart problems (Salving et al. 2008). With a nutritive value of 66g carbohydrates, 5g soluble fibre, 6g insoluble fibre, 17g protein, 54mg calcium, 0.119mg vitB6 and 56mcg of total folate per hundred grams, it also fulfils the nutritive requirement of old aged (Anonymous 2007). This is the only cereal containing a globulin or legume like protein avelins as the major (80 percent) storage protein. According to WHO, oat protein is equivalent to soy protein. Thus, it is one of the natural economic sources which can be included in every individual's routine diet. The nutritional properties of plants like oats are of great help in combating constipation. The consumption of oats is low due to unawareness of the common man about different tasteful ways in which it can be incorporated in daily diet. Keeping this into consideration, the present study aimed to develop and standardize fibre rich products from oats. Also, organoleptic and nutritive evaluation of the developed products was done.

METHODOLOGY

The samples of oats were procured from agronomy department Punjab Agricultural Univer-

sity, Ludhiana. All other ingredients were purchased from the local market. Supplementary product samples of sweet *dalia*, salty *dalia* and *khichdi* were prepared using broken wheat and rice as control while for test samples broken wheat for both sweet and salty *dalia* and rice were supplemented with oats at 20 percent, 25 percent and 30 percent levels. The control samples of sweet/salty *dalia* were prepared using 100g of rice and 20g of washed green gram dhal was used to prepare *khichdi*. The prepared products were evaluated thrice for their acceptability by a panel of 10 judges selected at random from the Department of Foods and Nutrition, College of Home Science, Punjab Agricultural University, Ludhiana. The judges were served with four samples of each product having one control and three experimental samples. Control sample was prepared from ingredients used in the normal or usual recipes and experimental samples were prepared by supplementing oats with the above mentioned levels. The samples were coded to avoid any bias. Judges were asked to score the samples for colour, flavour, texture, taste and overall acceptability by using a score card of nine point Hedonic Rating Scale. The control and the most acceptable level of oat supplementation in the products were analysed for proximate composition (moisture, crude protein, crude fat, crude fibre, total ash AOAC 1985) carbohydrates and energy were calculated. Fibre fractions namely Neutral detergent fibre (NDF), Acid detergent fibre (ADF) and lignin were also estimated on Fibra Plus (FES-6) Pelican equipment. The control samples and oat products having highest overall acceptability scores were dried in the oven at $65 \pm 2^\circ\text{C}$ in separate petri dishes. The dried samples were ground to a fine powder and were stored in airtight polythene bags for chemical analysis. The data was analyzed with the help of various statistical tools such as mean, standard deviation of the mean. To test the significant differences between the samples at different levels of oats incorporation ANOVA and student's *t*-test was applied using Microsoft Excel computer programme package on all the parameters.

RESULTS AND DISCUSSION

Organoleptic Evaluation of the Developed Products

A score of 7.9 for colour was obtained for salty *dalia* (Table 2) supplemented with 25 percent oats which was highest in comparison to

other levels of supplementation and was comparable with the control. The best score of 8.0 was obtained for taste by 25 percent level followed by 30 percent and 20 percent level of supplementation. There was a significant difference ($p < 0.05$) in all the sensory parameters of 30 percent and 20 percent levels which were liked moderately. Edema et al. (2005) reported a salty porridge developed from supplementation of soya with wheat in 1:9 ratio was highly acceptable by the panellists. Flander et al. (2007) reported that 10-20 percent of broken wheat can be easily replaced by oats in conventional porridge. This was in line with the present findings. The flavour of 25 percent level scored 7.5 which was comparable with the control. Highest scores of 7.9 and 7.7 were obtained for taste and overall acceptability of 25 percent level which was liked very much. Sweet *dalia* (Table 1) with 30 percent oat incorporation developed a sticky texture and was liked moderately. Lee and Inglett (2007) reported an increase in the adhesive properties by addition of 32 percent of beta glucan to batter formulations similar properties were observed in sweet *dalia* supplemented with 30 percent oats. There was a significant ($p < 0.05$) difference in the overall acceptability of the control and the 20 percent level which was liked moderately. Barka et al. (2004) developed a sweet porridge by supplementing rice to broken wheat at 25 percent, 30 percent and 40 percent level. It was concluded that the most acceptable level of supplementation was 25 percent as it scored highest points for all the sensory parameters which is equal to the present findings. The mean scores of colour ranged from 7.2 to 7.9 with higher score for 25 percent level which was comparable with the control and was liked very much. The highest score of 7.9 for taste was obtained by 25 percent level followed by 30 percent and 20 percent level of supplementation. *Khichdi* (Table 3) with 25 percent level of oat supplementation was liked very much with an overall acceptability score of 7.8 followed by 30 percent and 20 percent level which were liked moderately. Knuckles et al. (2006) reported that oat flour is one of the major component of infant and is well accepted at 10 percent level of supplementation.

Proximate Composition of Oat Supplemented Products

The moisture content of the salty *dalia* (Table 4) supplemented with 25 percent oats was 6.0 percent whereas the control had a higher mois-

Table 1: Organoleptic scores of sweet *dalia* (Mean \pm SE)

Sample	Colour	Appearance	Flavor	Texture	Taste	Overall acceptability
Control	7.60 \pm .16	7.50 \pm .17	7.60 \pm .16	7.60 \pm .16	7.80 \pm .20	7.62 \pm .08
S1	7.30 \pm .15	6.80 \pm .13	6.80 \pm .13	6.80 \pm .13	7.10 \pm .23	6.96 \pm .08
S2	7.90 \pm .10	7.80 \pm .25	7.50 \pm .17	7.60 \pm .22	7.90 \pm .18	7.74 \pm .09
S3	7.20 \pm .13	6.80 \pm .13	6.80 \pm .13	7.00 \pm .15	7.00 \pm .15	6.96 \pm .06
F-ratio	5.145**	8.145**	8.406**	5.889**	5.822**	6.216**
CD at 5%	.39	.51	.43	.53	.49	NS
Control- Broken wheat	S1- Broken wheat + 20percent Oats					
S2- Broken wheat + 25percent Oats	S3- Broken wheat + 30percent Oats					

Table 2: Organoleptic scores of salty *dalia* (Mean \pm SE)

Sample	Colour	Appearance	Flavor	Texture	Taste	Overall acceptability
Control	10.23 \pm .23	7.80 \pm .20	7.80 \pm .13	7.80 \pm .20	7.70 \pm .15	7.84 \pm .08
S1	6.40 \pm .16	6.80 \pm .13	6.70 \pm .15	6.70 \pm .15	6.80 \pm .13	6.68 \pm .07
S2	7.90 \pm .18	7.70 \pm .15	7.70 \pm .15	7.60 \pm .16	8.00 \pm .21	7.78 \pm .08
S3	6.90 \pm .10	7.10 \pm .18	6.90 \pm .10	6.90 \pm .10	6.90 \pm .10	6.94 \pm .05
F-ratio	21.269**	8.117**	16.610**	11.347**	14.643**	13.821**
CD at 5%	.50	.48	.39	.45	.44	.33
Control- Broken wheat	S1- Broken wheat + 20percent Oats					
S2- Broken wheat + 25percent Oats	S3- Broken wheat + 30percent Oats					

ture content of 10.0 percent. Supplementation of oats increased the crude protein and crude fibre content from 6.1 percent and 5.6 percent in control to 6.9 percent and 8.4 percent in the test sample. The high fibre content was due to oat supplementation and addition of vegetables. Edema et al. (2005) reported the crude protein and crude fibre content of porridge supplemented with soya in ratio of 1:9 to be 8.0 percent and 1.4 percent. The crude fat content of supplemented salty *dalia* was 6.2 percent and the control had 5.5 percent of fat. Curley (2008) evalu-

ated oat porridge and concluded lower values of crude protein, that is, 2.1 percent and 7.2 percent of crude fibre and 4.4 percent of crude fat.

The ash content in the test sample of sweet *dalia* (Table 4) supplemented with 25 percent oats was 1.7 percent the control sample had 1.5 percent of ash. The crude protein content increased due to addition of 25 percent oats to sweet *dalia* and was observed to be 6.9 percent whereas the control sample had 5.1 percent of crude protein. This was due to higher crude protein (12.01 percent) content present in oats. Barka

Table 3: Organoleptic scores of *khichdi* (Mean \pm SE)

Sample	Colour	Appearance	Flavor	Texture	Taste	Overall acceptability
Control	7.80 \pm .13	7.70 \pm .15	8.00 \pm .15	7.80 \pm .13	7.40 \pm .16	7.74 \pm .07
S1	7.50 \pm .17	6.70 \pm .21	7.50 \pm .17	6.60 \pm .16	7.20 \pm .20	7.10 \pm .10
S2	7.70 \pm .15	7.90 \pm .18	7.80 \pm .13	7.60 \pm .16	8.00 \pm .21	7.80 \pm .08
S3	7.60 \pm .16	7.30 \pm .15	7.30 \pm .15	7.40 \pm .16	7.30 \pm .15	7.38 \pm .07
F-ratio	0.698**	8.997**	4.245**	11.329**	3.845**	3.509**
CD at 5%	NS	.50	.43	.44	.52	.28
Control- Rice	S1- Rice + 20percent Oats					
S2- Rice + 25percent Oats	S3- Rice + 30percent Oats					

Table 4: Proximate composition of fibre rich products from oats

Products	Moisture (percent)	Total Crude ash (percent)	Crude protein (percent)	Crude fibre (percent)	Fat (percent)	Carbohydrate (percent)	Energy (percent)
Sweet <i>dalia</i> control test	8.06.0	1.51.7	5.16.9	2.16.7	4.25.4	7873	374369
Salty <i>dalia</i> control test	10.06.0	2.43.5	6.16.9	5.68.4	5.56.2	7068	355359
<i>Khichdi</i> control test	9.04.0	0.420.88	11.013.0	0.023.21	5.05.9	7472	387397

et al. (2004) reported the crude protein content of sweet porridge made from supplementing rice to broken wheat to be 2.3 percent. The crude fibre content of test sweet *dalia* sample was 6.7 percent and was significantly ($p > 0.05$) higher than the control having 2.1 percent of crude fibre. Barka et al. (2004) reported 2.6 percent of crude fibre content of wheat porridge made by supplementing rice to broken wheat.

The moisture content of *khichdi* (Table 4) supplemented with 25 percent level was observed to be 4 percent while the control had significantly ($p < 0.05$) higher moisture content of 9 percent. The moisture content may be low due to high fibre content (6.9 percent) and lower moisture content (5.5 percent) in oats. Addition of 25 percent oats to *khichdi* increased the total ash, crude protein, fibre and fat from 0.42 percent, 11 percent, 0.02 percent and 5 percent in control to 0.88 percent, 13 percent, 3.2 percent and 5.9 percent in the test *khichdi*.

Fibre Fractions of Sweet/ Salty *Dalia* and *Khichdi*

The NDF, ADF and lignin content of salty *dalia* (Table 5) supplemented with 25 percent oats increased to 18.8 percent, 3.7 percent and 1.8 percent from 17.2 percent, 2.9 percent and 1 percent present in the control sample. Edema et al. (2005) reported the NDF, ADF and lignin values of soy *dalia* to be 16.2 percent, 5.2 percent and 1.7 percent respectively were nearly equal to salty *dalia* supplemented with 25 percent oats.

Table 5: Fibre fraction of fibre rich products from oats

Products		NDF (per- cent)	ADF (per- cent)	Lignin (per- cent)
Sweet <i>dalia</i>	Control	16.4	3.1	1.4
	test	17.7	4.1	2.1
Salty <i>dalia</i>	Control	17.2	2.9	1.0
	test	18.8	3.7	1.8
<i>Khichdi</i>	Control	16.1	2.6	1.1
	test	18.2	4.2	1.7

The NDF and lignin value of the control sweet *dalia* (Table 5) was 16.4 percent and 1.4 percent while supplementation of oats at 25 percent level increased it to 17.7 percent and 2.1 percent. The ADF value of the test sweet *dalia* was 4.1 percent while the control sample had lower value of 3.1 percent. There was a significant ($p < 0.05$) difference between the test and the control sample.

The value of ADF for the test *khichdi* (Table 5) was 4.2 percent which was significantly ($p < 0.05$) higher than the control having 2.6 percent of ADF. The control sample of *khichdi* showed content of NDF at 18.2 percent and lignin at 1.7 percent while the control had 16.1 percent of NDF and 1.1 percent of lignin.

CONCLUSION

The developed products were found organoleptically acceptable. Supplementation of products with oats increased the crude protein, crude fibre, and fat content in comparison to the normal preparations. There was also an increase in the fibre fractions of the supplemented fractions too.

RECOMMENDATIONS

Products like sweet /salty *dalia* and *khichdi* can easily be supplemented with oats without altering their palatability. They are highly acceptable organoleptically and can be included very easily in the geriatric diet. Thus, they are of great help in preventing constipation among old aged. Consumption of oat supplemented products should be encouraged as these are of higher nutritive value and can be made a part of routine diet of healthy individuals.

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