Pasta Quality Traits of some Durum Wheat Varieties

P. Irani

ABSTRACT

To evaluate durum pasta quality traits, using international standards, a study was conducted on seven improved and local durum wheat varieties. The traits examined included grain vitreousity (I.CC. No. 129), grain hardness index (h.i.), yellow berry (y.b.(, black point (h.p.), hectoliter weight (h.l.w.), thousand kerne! weight (t.k-w.j, protein percentage (I.CC. No. 105.1), protein quality through sedimentation test (I.CC. No. 116), and wet gluten percentage. Durum wheat gluten quality can be used to detect varieties with favorable traits for pasta making:, some of these traits being: semolina percentage, pigment content, reaction to cooking and pasta disk pressure tolerance. The varieties Zardak from Kermanshah, Altar 84 from Ahwaz and Yavaros 79 from Karaj exhibited the most favorable pasta quality traits. There existed significant positive correlations (at *1%* level) between protein percentage and sedimentation test, wet gluten percentage and protein, wet gluten and sedimentation test, and protein percent and dry gluten. The results indicated that protein percentage of durum wheat varieties can be used to select varieties of favorable quality for pasta making.

Keywords: Durum wheat , Pasta , Qualily.

INTRODUCTION

Pasta protein content (12-14%) is high as compared with rice (7%). It can also be stored for a long time making it an important nutritious food. Consequently, there is an increasing demand lor it. Consumption of pasta is expanding in persian people's diets. Pasta is produced in a variety of different sizes and shapes such as spaghetti, macaroni and vermishels, so named because of ihcir shell shape.

Semolina of durum and bread wheat are commonly used in pasta industries either in mixture or separately. Due to shortage of durum, semolina in Iran, common bread wheat flour is used in pasta production resulting in technological difficulties as well as reduced quality.

Despite high consumption of pasta in Iran, little research has been conducted on pasta products. The establishment and equipping of the technology durum research unit in the cereals technology and chemistry laboratory of Ihe Seed and Plant Improvement Institute in Karaj has helped in the selection of good durum wheat varieties for pasta production and their release as favorable varieties. Cereal research, including durum yield trials have shown that there are some high yielding durum varieties, for instance Zardak for rainfed, and Yavaros 79 and Altar 84 for irrigated areas, that are ready to be released.

These varieties have yellow, vitreous kernels, are high in protein content and are of desirable cooking quality. Cultivation of these varieties

[1] Iranian Agricultural Engineering Research Institute, P.O.Box 31585-845, Karaj, Islamic Republic of Iran.

to produce durum wheat can finally lead to an increase in total production and consumption of pasta in Iran.

MATERIALS AND METHODS

In this study 7 durum wheat varieties: Zardak from Kermanshah, Altar 84, Cr "S" and Zard-Kooleh from Ahwaz, Blich2, Altar 84 and Yavaros 79 from Karaj were examined during the years 1990 and 1992, but some of the entries were harvested and studied only in 1992 (table 1).

To determine pasta quality characteristics and the reaction of pasta to cooking, the disc-method was used to produce pasta.

Grain Quality Traits

Samples were checked for vitreous cross section, grain hardness index, yellow berry, black point, hectolitre weight, thousand kernel weight and suny bug damage.

Chemical Traits

Grains were ground and using international cereal chemistry (I.C.C.) methods, were tested for protein percentage (I.C.C.No. 105/1), Zeleny No. (sedimentation test, il.CC. No. 116), gluten quality, dry gluten percentage, gluten- index (I.C.C.No. 106/1) and alfa-amylase activity (I.C.C.No. 107) .

Cooking Trait Evaluation

Specific cooking and tangible evaluation of pasta was done based on the disc method (11). Wheat grain samples were ground with a special durum grinder using the semolina sieve to separate and get the flour.

Semolina extraction from durum varieties was used to get their pigment rates.

Samples of semolina from each durum variety were used to make pasta disc using special

molds (bars) under 80 atmosphercic pressures.

Pasta-discs were cooked for 16, 20, 24, 28 and 32 minutes. The cooked discs were put under pressure of two kilograms and finally the flabby were evaluated.

Based on the international standards, long type pasta in the form of Napoli (water + semolina) was made, using a pasta maker machine. Different pasta traits such as: vitreousity of pasta surface, smoothness of and cracks on surface were evaluated before cooking. After cooking, pasta traits such as taste, chewing quality, and smoothness were also evaluated. The performance of cooked pasta in various dishes was studied too.

RESULTS External Quality Traits

A summary of results is given in table one. Existence of both yellow-berry and black points have an impact on semolina and its marketing. Due to the dry climatic conditions which cover most parts of Iran, there were no black points on any samples, but there was some yellow berry observed on samples.

Chemical Traits

Result of physical and chemical tests are shown in table one. Protein content of the samples harvested in the 1990-91 growing season ranged from 10.3 to 17.1% while for the 1991-92 growing season the range was only 7.6-12.6% .

Wheat Varieties

Since it is generally accepted that protein content of less than 12% is not acceptable for good quality pasta production (2,8), samples from the 1991-1992 season need to be newed with some reservations. There are fluctuations in the zeleny figures related to protein percentage.

In 1990-91 harvest, zcleny values ranged from 23-32, whereas in 1991-1992 the range was only 11-20, which is low. Similarly for wet gluten content, which should not be less than 27% the results lor 1990-91 were 24-45% , whereas for 1991-92. 21-31%, indicating that the 1991-92 samples were not suitable for pasta production (table 1).

Gluien elasticity should be at normal level, (i.e. when pulled by hand it should stretch from round to 12 cm long, before being lorn apart). This trait was weak in Zard kooleh making it not suitable for pasta making.

Semolina content, different in quality were of three lypes. no. 1 and no. 2 clean and branless and no. 3 with a little bit of bran.

Semolina extraction rates for the first two were shown 45 to 58% for 1990-1991 harvest, while for 1991-92 harvest the range was 48-55%- (table 1),

To prepare the semolina, special types of grinders equipped with special rollers were used. As during the pasta production should occur, the low activity of alfa-amylase of the varieties was not a problem. The fluctuation range for this specific trail was 684-1725 seconds. The highest *(1129* sec.) was recorded for Zardak and the lowest (623 see.) for Blich2 from Karaj.

Table 1. Eperimental physical and chamical properties of durum wheat samples.

Year	1990-91			1991-92						
Varieties	Cr"S"	Zardak	Z.Koole	Cr"S"	Zardak	Z.Koole	Altar(Ah.)	Altar(Ka.)	Blich(Ka)	Yavaros(Ka.)
t.k.w. (gr.)	38	34	26	44	47	44	50	44	44	54
h.l.w. (K.gr.)	80.8	75.7	67.5	80.4	79.2	81.2	82.7	–	–	–
k.s.% (2/8 mm)	59	10	3	55	61	42	76	62	58	88
k.m.%	9.1	9.2	9.2	9.1	5.2	8.7	9.2	8.5	9.2	8.6
y.b.%	30	-	9	51	8.5	7.5	5.5	43	5	1
h.i.	72	68	63	62	75	70	63	64	63	66
pro%	10.5	17.1	13.7	7.7	11.1	12.1	10.9	7.6	11.3	12.0
s.t.	23	32	25	19	16	20	15	11	16	14
w.glu.%	24	45	32	23	31	30	25	21	26	29
glu.I.	70	31	18	86	16	30	64	23	73	27
glu.e.	h	n	s	h	s	s	h	n	h	n
d.glu.%	8	15	11	5	10	11	6	5	8	11
semo%	51	58	45	54	50	48	55	48	50	48
f.t.(sec.)	983	1729	1727	828	878	948	978	684	623	840
c.t.(min.)	20	32	16	28	16	16	32	16	20	32

Key to abbreviations:
t.k.w.= thousand kernel weight (gr.), h.l.w.= hectolitre weight (Kgr.), k.s.= kernel size (mm), k.m.= kernel moisture% , y.b.= yellow berry% , h.i.= hardness index , pro=protein% , s.t.= sedimentation test , w.glu.=wet gluten% , glu.i.=gluten index, glu.e.=gluten elasticity (h=hard, s=soft, n=normal), d.glu.=dry gluten% , semo.=semolina% , f.t.=falling time(seconds), c.t.=cooking time (minutes).

Table 2. Sample **correlation coefficient**

	t.k.w.	k.s.	k.m.%	h.i.	pro%	s.t.	w.glu.%	glu.i.		semo%	f.t.(sec.)
c.t	0.14	0.03	0.41	-0.33	0.24	0.32	0.28	0.49	0.02	0.93b	0.24
f.t.	-0.83b	-0.90b	0.27	-0.04	0.86b	0.86b	0.80b	-0.38	0.77a	0.13	
semo%	0.25	0.11	0.17	-0.03	0.24	0.33	0.35	0.43	0.11		
d.glu%	-0.57	-0.77a	-0.08	-0.43	0.94b	0.80b	0.95b	-0.53			
glu1	0.32	0.47	0.48	-0.37	-0.40	-0.12	-0.46				
w.glu%	-0.50	-0.75a	-0.06	0.29	0.94b	0.80b					
S.I.	-0.75a	-0.81b	0.31	0.1S	0.81b						
pro%	-0.56	-0.75a	0.12	0.21							
h.i.	-0.08	0.06	-0.67a								
k.m.%-	-0.30	-0.25									
k.s.	0.90b										

a and b significant at 5% and 1% respectively

Cooking Experiment

Physical gluten traits of durum discs and pasta cooking quality characteristics at cooking times of 16, 20, 24, 28 and 32 minutes were studied (11). Zardak which alter 32 minutes of cooking withstood two kilograms of pressure and was not mashed, was the best variety lollowcd by Altar 84 from Ahwaz and Yavaros 79 from Karaj in 1991-92 harvest. These varieties are recommended for pasta making. Pasta produced from these strong gluten content types with more yellow semolina, made the most desirable one.

DISCUSSION

The results show that the existance of yellow berry was related to low protein content, with protein being substituted by starch. This has the negative effect of decreasing semolina production.

In 1990-91 harvest the variety Zardak without any yellow berry and in 1991-92 with 8.5% yellow berry produced 58% and 50% semolina, respectively.

There was also some decrease in semolina production of other samples observed due to yellow berry. Black points which result from humid climatic conditions and lead to decrease in colour and vilreousness of pasta surface, were not observed due to the dry elimatieal conditions at the production site. The thousand kernel weight of the samples were mostly high, except for Zard kooleh from Ahwaz. Warm climatic conditions resulted in rapid maturity and reduced starch deposition giving low grain weight. This also decreased the hectolitre weight to below the standard level. Hectolitre figure for the remaining samples was acceptable.

Grain hardness-index which is one of the important trails in semolina production in durum wheat, must not be less than 65. Semolina production traits are grain hardness-index, moisture content and extraction rate (3,6,7,10).

There was a negative correlation between grain hardness-index and moisture content at 5%- level. There was a positive correlation between thousand kernel weight and kernel size at 1% level of significance.

Samples of durum wheat during 1990-91 had higher protein content than samples taken during 1991-92.

Samples of zardak variety harvested in

1991-1992 had lower protein content due to insufficient amunl of rainfall in rain-fed areas.

There was a positive correlation between protein percent and zeleny number (sedimentation-test). Seasonal fluctuation of protein percentage was reflected in variation of zeleny number (3,7). This means that in 1990-91 harvest the high protein content of samples resulted in acceptable zeleny numbers, whereas in 1991-92 the big decrease in protein content caused low and unacceptable zeleny, lower than the standard gluten percentage values. The existence of low gluten elasticity in tow varieties Zardak and Zard-kooleh was due to suny bug damage, something which was also obvious from external examination of grain samples.

There was a significant positive correlation (1% level) between gluten content and zeleny number. This relation helps to determine durum varieties with high pasta quality (2,3,4,6,8).

Cooking quality results were influenced by protein quality and percentage, gluten quality and pigment percentage (1,2,3,6,7,8).

The experiments showed that the durum varieties Zardak from Kermanshah, Altar 84 from Ahwaz and Yavaros 79 of Karaj from among all others were the best for pasta production.

Data from yield trials and laboratory pasta quality tests indicate that the three durum varieties, Zardak, Altar, Yavaros could be released to farmers through the Seed and Plant Improvement Institute for large scale, cultivation.

REFERENCES

1. Dexter, J.E., and Matsuo R.R. 1977. Effect of Semolina Extraction Ratio on Semolina Characteristics and Spaghetti Quality. Canadian Grain Commission, Winnipeg, Manitoba. *Cereal Chem.,* 55(6): 352-841.
2. Dexter, J.E., and Matsuo R.R. 1977. Influence of Prolein Content on Some Durum Wheat Quality Parameters. *Can. J. Plant S&,* 57: 717.
3. Fabriani, G., and Lintas. 1988. *Durum Wlieat,* Chemistry and Technology, Institute Nationale Delia Nulrizione, Rome, Italy.
4. I.C.A.R.D.A. 1998. *Crop Quality Evaluation, Methods and Guidelines.* Technical manual (Rev. 1) Box 5466, Aleppo, Syria.
5. I.C.C. Standards. 1988. Morilz Verlag, Schuetzenbcrg 12, Detmold, Germany.
6. Irvine, G.N., and Anderson J.A. 1958. Variation in Principal Quality **Factors** of Durum Wheat with a quality prediction test for wheat or semolian. *Cereal Chem.,* Vol. 30: 334-342,
7. Kent and Amos. 1967. *Modern Cereal Chemi stry,* Food Trade Press Ltd. London, England.
8. Matsuo, R.R., Bradley, J.W., and Irvine G.N. 1972. Effect of Protein Content on the Cooking Quality of Spaghetti, *Cereal Chem.,* 49; 707.
9. Matsuo, R.R. 1971. Note on Improved Apparatus for Testing Spaghetti Tenderness. *Cereal Chem.,* 48: 707.
10. Milling Flour and Feed. 1993. European Directory, Ecrts WD3 ISN, UK.
11. Seibel, W., Feillet, P., and Alause. 1977. Disc Method Apparatus for Testing Pasta Disc and Spaghetti. B.F.A.f.G.u.K.V. Schuetzenberg, Detmold, Germany.

خواص کیفی ماکارونی گندم‌های دوروم

چکیده

در این بررسی خواص کیفی ماکارونی هفت رقم از گندم‌های دوروم بومی و اصلاح شده با استفاده از روش‌های بین‌المللی I.C.C) International Cereal Chemistry) مورد مـطالعه قـرار گرفتند. صفات مورد بررسی شامل خصوصیات فیزیکی دانه: تعیین سختی دانه، درصد شیشه‌ای طبق روش (I.C.C.No. 129) درصد لکه‌های آردی و قهوه‌ای، وزن هکتولیتر با استفاده از دستگاه تعیین وزن هکتولیتریک لیتری، وزن هزار دانه با استفاده از دانه‌شمار نومیگرال، تعیین درصد رطوبت و سپس خصوصیات شیمیائی گندم‌ها شامل: درصد پروتئین بـا استفاده از روش (I.C.C.No. 105.1) کیفیت پروتئین یا عدد زلنی با روش (I.C.C.No. 118) درصد گلوتن مرطوب و خشک با استفاده از روش (I.C.C.No. 106/1) به کمک دستگاه گلوتوماتیک، کیفیت گلوتن یا اندیس گلوتن با استفاده از سانتریفوژ ۶۰۰۰ دور در دقیقه، درصد سمولینا با استفاده از آسیاب گندم دوروم شوپن (Chopin) ، درصد مواد رنگی موجود در سمولینا طبق روش پیشنهادی ایکاردا، کیفیت ماکارونی و کیفیت پخت با استفاده از روش (Disc Method) تهیه ماکارونی تیپ بلند به روش ناپولی (آب و سمولینا) با دستگاه ماکارونی‌ساز آزمایشگاهی و بررسی خواص کیفی جویدن، حالت قرار گرفتن ماکارونی در بشقاب و آزمایشات حسی انجام گردید. نتایج بررسی‌ها نشان دادند که ارقام زردک از منطقه کرمانشاه، یا واروس از منطقه کرج، آلتـار ۸۴ از منطقه اهواز بهترین ارقام دوروم جهت تولید ماکارونی مرغوب می‌باشند. ضمناً بـین درصـد پروتئین و عدد زلنی، درصد پروتئین و درصد گلوتن همبستگی مثبت در سـطح ۱٪ وجـود داشت. بنابراین با توجه به نتایج فوق پروتئین بیشتر از ۱۲/۵٪ می‌تواند بعنوان یک عامل تعیین کننده در انتخاب ارقام گندم خوب دوروم برای تولید ماکارونی مرغوب محسوب شود.