Results and Discussions

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The triticale have some variations in technological properties of grains and flour when compared to wheat as well as comparison between Sakha (69) wheat and mixture of some triticale varieties. In this work studying of and chemical properties of some triticale varieties have been achieved.

Technological Properties of Grains.

The study was extended to data presented in table (1) show that 1000-kernels weight in triticale was higher than that of wheat grain (43.17gms., 41.30 gms.) for triticale and wheat, respectively. But the vetrousity in wheat was higher than that in triticale, it was (62.20%) in wheat while in triticale was (46.0%).

The hectoliter weight was higher in wheat grains than that in triticale grains, it was in wheat grains (79.20 Kg /100 L) but in triticale grains it was (78.20 Kg / 100 L) this may be due to the shriveling of triticale kernels than that in wheat grains so it has less endosperm. In the same time triticale has less density than wheat grains. wheat grains can vary from partially shriveled grains or wrinkled compared to fully plump. The vitreousness percentage in triticale grains was lower than that in wheat grains as reported by **Bushuk and Larter (1980).**

Also the extraction percent which is presented in table (1) Indicates that it was (56.11%, 33.53%, 10.36%) for (flour, bran and shorts respectively in triticale) but in wheat counterparts it was (64.00 %, 27.00% and 9.00% respectively).

This indicates that triticale grains have low extraction rate compared with wheat grains. This may be due to triticale grains it was shriveling.

In table (1) The Pelishinke test value in triticale whole meal was lower than that in wheat whole meal because the gluten net work In triticale was weaker than that in wheat, it was 35 min. and 68.5 min. in triticale and wheat meals, respectively.

Chemical Composition of Grains.

The chemical composition of triticale and wheat grains was represented in table (2). There were significant differences between wheat and triticale in chemical composition of grains. Triticale grains have slightly lower contents of (ash, ether extract, total crude fibers and total dietary fibers) than those of wheat, were (1.74%, 1.90%, 2.30% and 1.9%, respectively in triticale). While those in wheat grains were (1.86%, 2.07%, 2.50% and 2.00%, respectively).

Concerning proteins there were significant differences between wheat and triticale grains. The protein amount in wheat grains was higher than that in triticale grains (15.10 and 12.98%, respectively in wheat and triticale). Also triticale grains had higher contents of (total soluble sugars, starch, total carbohydrates and total hydrolysable carbohydrates) than those of wheat. (2.15%, 78.83%, 83.38 % and 81.08%, respectively in triticale) while they were (1.72 %, 76.60 % , 80.97% and 78.45%, respectively in wheat). Soluble sugars in triticale was higher than that in wheat it may be due to the higher activity of ∝-amylase in triticale than that in wheat grains. Generally these results revealed the difference in chemical composition between the triticale and wheat grains.

Table (1): Technologicale characteristics of triticale and wheat grains.

Sample	1000 Kernels wt.	Vetrousity (%)	Hectoliter (Kg/100 L)	Pelishenke test (min.)	Flour %	Bran %	Shorts %
Triticale	43.17	46.61	79.2	35	56.11	33.53	10.36
Wheat	41.3	62.2	78.2	68.5	64.0	27.0	9.0

Table (2): Approximate chemicale composition for triticale and wheat grains.

Chemicale composition content %	Triticale	Wheat
Moisture	9.00	10.85
Ash	1.74	1.86
Crude Protein	12.98	15.1
Crude fat	1.9	2.07
Crude fibers	2.3	2.5
Totale dietary fibers	1.95	2.00
Totale soluble sugars	2.15	1.72
Starch	78.83	76.6
Totale carbohydrats	83.38	80.97
Totale hydrolysable carbohydrats	81.08	78.45

* On dry basis.

Chemical Composition of Triticale and Wheat Flours.

Chemical composition of triticale and wheat flours were presented in table (3). Wheat flour had higher contents of (protein, ether extract and total crude fibers). They were in wheat flour (13.90%, 0.90%, 0.31% and 0.25%, respectively). But in triticale flour they were (11.74%, 0.73%, 0.28% and 0.22%, respectively). While triticale flour had higher contents of (ash, total soluble sugars, starch, total carbohydrates and total hydrolysable carbohydrates) than those of wheat flour. They were (0.71%, 3.99%, 82.54%, 86.80% and 86.53, respectively in

Table (3): Proximate chemical composition of triticale and wheat flours.

Chemical componants content %	Triticale	wheat
Moisture.	11.4	10.44
Ash.	0.71	0.55
Crude Protein.	11.74	13.9
Crude Fat.	0.73	0.9
Crude Fibers.	0.28	0.31
Total Soluble Sugars.	3.99	2.73
Total Dietary Fibers.	0.22	0.25
Starch.	82.54	81.59
Total Carbohydrates.	86.8	84.63
Total hydrolysable Carbohydrates.	86.53	84.33

* On dry basis.

triticale flour). But they were (0.55%, 2.73%, 81.59%, 84.63% and 84.33%, respectively in wheat flour). These results are in agreement with the findings by **Zillinsky and Borlaug (1971).** who Indicated that protein contents for 19 lines of triticale are grown at C.I.M.M.Y.T. in (1970/69) ranged from (12.80-17.90%, respectively). Also **France and Lourence (1981).** Founded that the triticale grains of two lines were tested it was found that their protein content were (8.58%, 11.19%, respectively).

Amino Acids Composition .

The data presented in table (4). Indicated the protein of the triticale flour. This protein had higher percents of amino acids as (lysine, asparatic, arginine, threonine, alanine, lucine) than those in wheat flour protein. (3.30, 6.7, 5.22, 3.24, 4.08 and 7.06 gm/100 gm. protein respectively in triticale). While they were (2.00, 4.33, 4.11, 2.30, 3.20 and 6.01 gm./100 gm. protein respectively in wheat). But the wheat flour protein had higher quantities of amino acids as (tyrosine and glutamic) than their in triticale flour protein it was (3.60, 33gm/100 gm protein respectively in wheat). But its (2.85, 30.40 gm/100 gm. protein respectively in triticale). These results are in agreement with the findings of **Chung *et al.* (1983).** Thus the triticale flour protein had higher contents of lysine, phenylalanine and methionine than those in wheat flour protein. **Siddique *et al.* (1985).**

Table (4): Constitient amino acids of proteins of triticale, wheat and their flour blends.

Serial No.	Amino Acids	Sample (1)	Sample (2)	Sample (3)	Sample (4)	Sample (5)
1	Lysine	3.3	2.00	2.33	2.65	2.98
2	Histidine	2.42	2.3	2.33	2.36	2.39
3	Arginine	5.22	4.11	4.39	4.67	2.94
4	Tryptophan	1.09	1.31	1.26	1.2	1.15
5	Aspartic	6.71	4.33	4.9	5.51	6.12
6	Threonine	3.24	2.3	2.54	2.77	3.01
7	Serine	4.87	4.5	4.59	4.69	4.78
8	Glutamic	30.4	33	31.05	31.5	31.95
9	Proline	10.36	10.4	10.39	10.38	10.37
10	Glycine	4.42	4.6	4.56	4.51	4.47
11	Alanine	4.08	3.2	3.42	3.64	3.86
12	Cystine	2.98	2.9	2.92	2.94	2.96
13	Valine	4.54	4.6	4.59	4.27	4.56
14	Methionine	1.70	1.3	1.4	1.5	1.6
15	Isoleusine	3.78	3.5	3.57	3.64	3.71
16	Leucine	7.06	6.01	6.27	6.54	6.8
17	Tyrosine	2.85	3.6	3.41	3.25	3.04
18	Phenylalanine	4.92	4.6	4.68	4.76	4.84

Sample (1)- triticale amino acids.

Sample (2)- wheat amino acids.

Sample (3)- (25% triticale + 75% wheat) blend.

Sample (4)- (50% triticale + 50% wheat) blend.

Sample (5)- (75% triticale + 25% wheat) blend.

Protein Fractions.

Figure (1) Present the histograms of protein fractionation by different solutions the water-soluble proteins in triticale flour

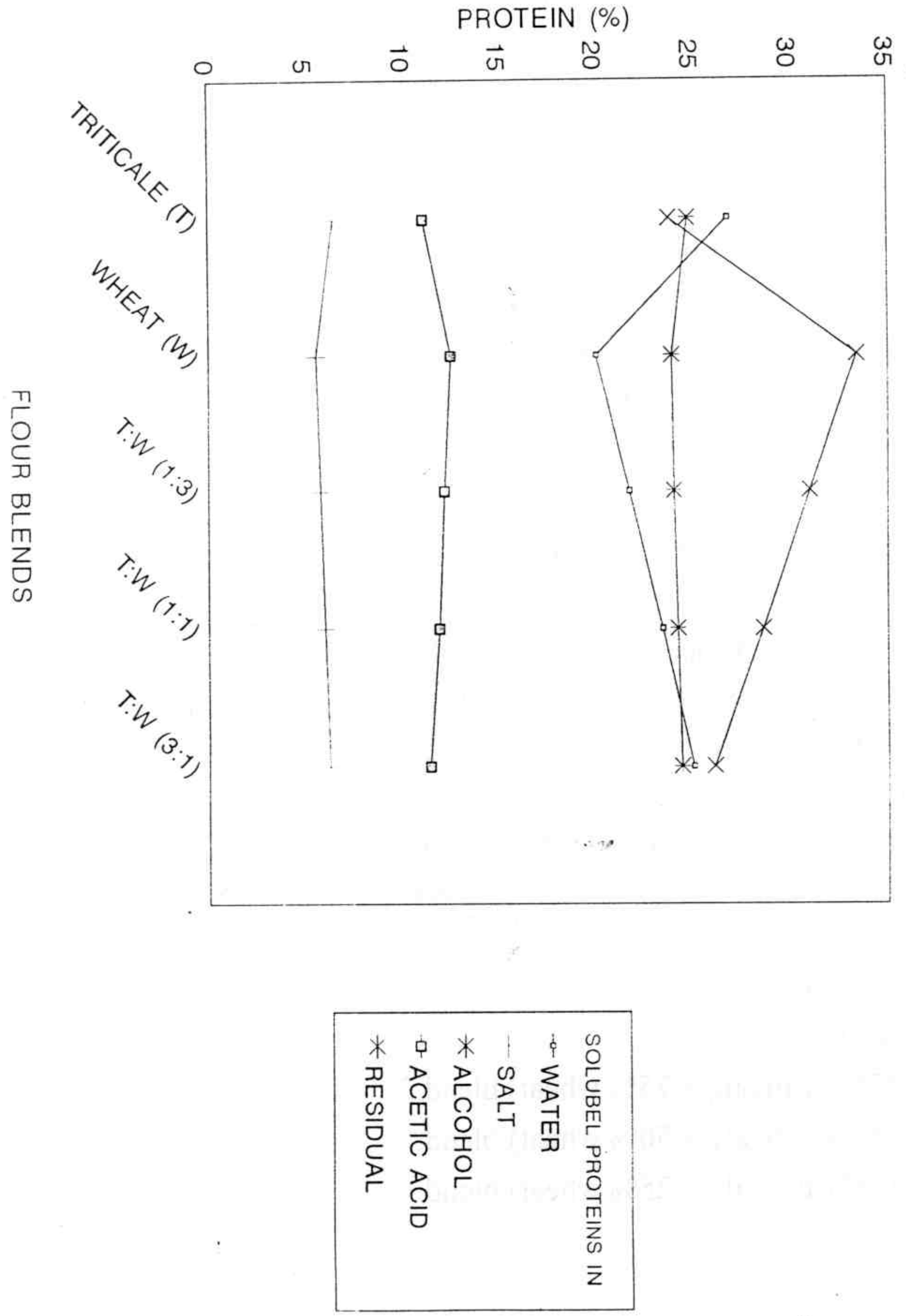


Fig. (2): The solubility of endosperm proteins for Triticale and Wheat and their blends.

was higher than that of wheat flour with significant difference but slightly higher in salt-soluble proteins and alcohol-soluble proteins than that in wheat. Otherwise the wheat flour had higher contents of acetic acid-soluble proteins and residue, higher than those in triticale flour. Table (5). Indicates that the water-soluble proteins, salt-soluble proteins and the residue proteins in triticale flour were (26.82%, 6.38%, 24.47%, 11.01% and 23.77%, respectively). But in wheat flour it was (20.00%, 5.5%, 23.9%, 12.40% and 33.40% respectively).

In wheat-triticale flour blends the water-soluble proteins, salt-soluble proteins and alcohol-soluble proteins contents decreased in blends by wheat flour increase but acetic acid-soluble proteins and residue contents were decreased in the blends by wheat flour decreased.

Table (5): Protein fractions extracted by various solvents.

Protein fractions.	1	2	3	4	5
Water- Soluble Proteins.	26.82	20.00	21.71	23.41	25.00
Salt-Soluble Proteins.	6.38	5.5	5.72	5.94	6.16
Alcohol-Soluble Proteins.	24.47	23.9	24.00	24.2	24.38
Acetic acid-Soluble Proteins.	11.01	12.4	12.06	11.8	11.3
Residue.	23.77	33.4	30.99	28.6	26.1

1. Triticale
2. Wheat
3. (25% triticale + 75% wheat) blend.
4. (50% triticale + 50% wheat) blend.
5. (75% triticale + 25% wheat) blend.

These results are in agreement with the findings of **Chen and Bushuk** (1969b).

Electrophoresis of Protein.

Figure (2). Show that the sodium dodecyl sulfate-poly acrylamyd gel electrophoregram and table (6) reveal that the protein bands are present in triticale proteins and wheat proteins.

The proteins in bands (5, 7, 12, 14, 15, 36, 37 and 39) it had molecular weight (34.67, 52.48, 67.92, 72.44, 83.18, 186.20, 192.75 and 197.29 KDa.) they were founded in triticale flour proteins but not found in triticale flour proteins. Otherwis protein in band (6) has molecular weight (44.67 KDa.) it was found in wheat flour proteins but it wasn't found in triticale flour proteins. Other proteins were found in both types of flour proteins because triticale flour proteins initiate with that proteins from it's two parents (wheat & rye) all the triticale protein zones disc gel electrophoresis patterns were present in their parents as reported by **Chen and Bushuk (1969c).** Also all proteins of the glutenin of the triticale are present in the glutenins in either of its two parents. this results are as reported by **Orth *et al.* (1974).** But this results are in different from those of **Yong and Unrau (1964).** And the electrophoregrams of the triticale protein fractions were generally similar but not identical to the electrophoregrams of the corresponding combined fractions of the two parents there was some quantitative and qualitative differences in the proteins of triticale and its parents. as Reported by **Lei and Reeck (1986).** And in (S.D.S.-P.A.G.E.) indicated that, each protein fractions from triticale was composed of mixture of the equivalent fraction from both parents. Molecular

Table (6): Molecular weight of triticale and wheat flour proteins as reveale from sodium dodycil sulfat – poly acrylamid gel. In ge electrophoregram.

Serial No.	Molecular weight	(1)	(2)	Serial No.	Molecular weight	(1)	(2)
1	24.55	+	+	23	120.22	+	+
2	26.3	+	+	24	123.03	+	+
3	30.2	+	+	25	124.45	+	+
4	31.92	+	+	26	128.82	+	+
5	34.67	(-)	+	27	131.83	+	+
6	44.67	+	(-)	28	134.9	+	+
7	52.48	(-)	+	29	144.54	+	+
8	54.83	+	+	30	153.11	+	+
9	61.16	+	+	31	156.68	+	+
10	63.1	+	+	32	158.49	+	+
11	66.07	+	+	33	164.06	+	+
12	67.92	(-)	+	34	165.96	+	+
13	69.18	+	+	35	177.83	+	+
14	72.44	(-)	+	36	186.21	(-)	+
15	83.18	(-)	+	37	192.75	(-)	+
16	91.2	+	+	38	194.98	+	+
17	93.33	+	+	39	197.29	(-)	+
18	94.41	+	+	40	199.53	+	+
19	102.1	+	+	41	202.25	+	+
20	104.71	+	+	42	208.93	+	+
21	109.65	+	+	43	218.78	+	+
22	113.5	+	+	44	223.87	+	+

1) wheat proteins.

2) Triticale proteins.

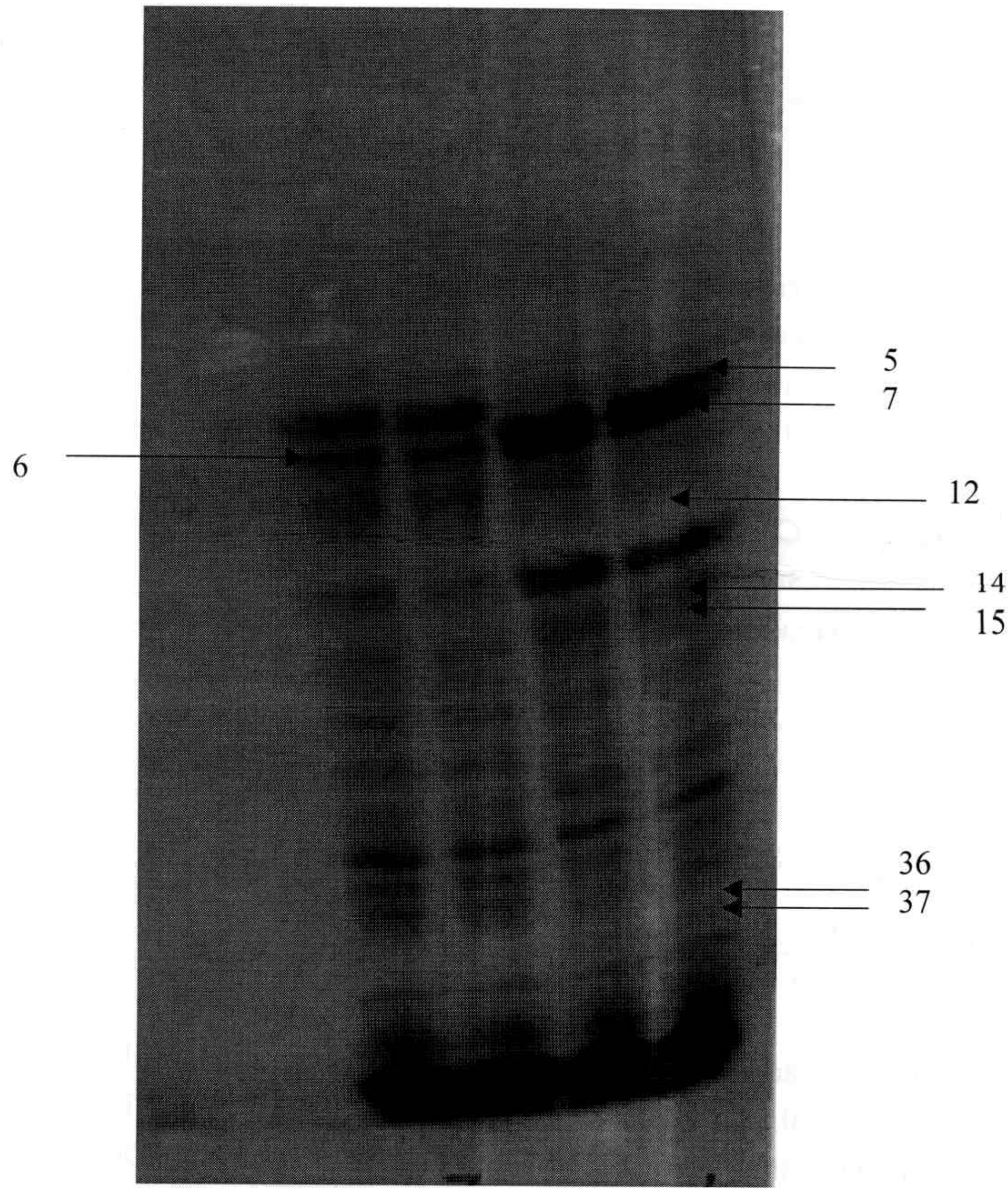


Fig.(2): The proteins bands according to S.D.S-P.A.G.E. for triticale flour proteins and wheat flour proteins.

weight ranged from (24.55-223.87 KDa.) in proteins were presented in wheat and triticale flours .as sayed by **Navarro *et al.* (1995)**.

Wheat and Triticale Starchs Characteristics.

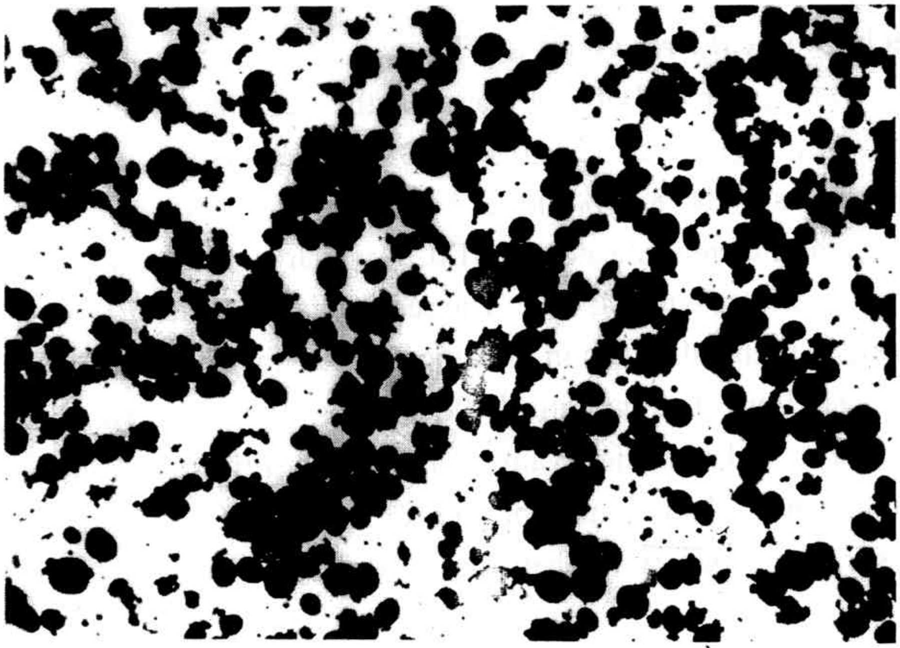
In figure (3). It is clear that the triticale starch granules like that of wheat but it was smaller than that in wheat. It is clear from table (7) that the triticale starch had lower contents of (ash,

Table (7): Chemical composition of triticale and wheat starches.

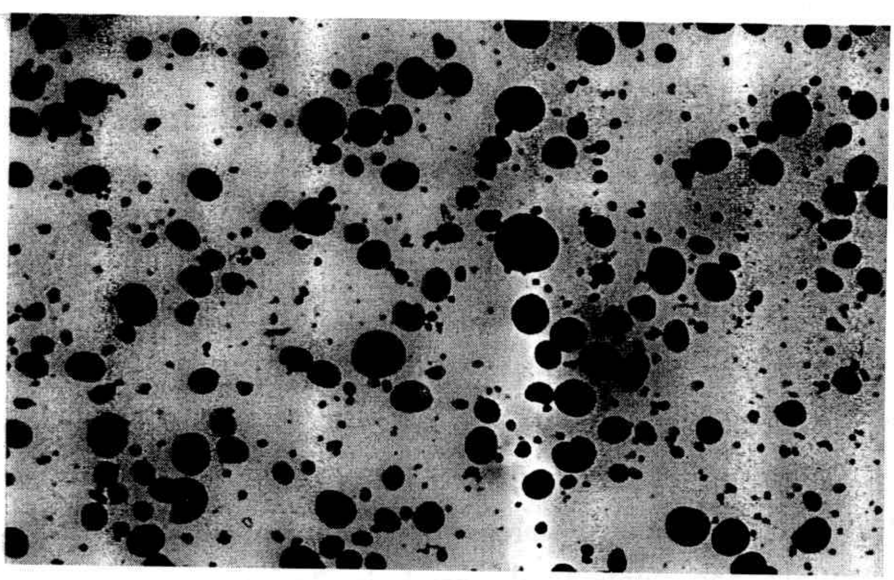
Chemical compositions %.	Triticale starch.	Wheat starch.
Moisture.	13.9	14.5
Ash.	0.17	0.22
Protein.	0.58	0.71
Crude Fat.	0.1	0.09
Amylose.	23.75	22.75
Amylopectin.	76.25	77.25

*On dry basis.

protein and amylopecten) than those of wheat starch while were (0.17, 0.58 and 76.25%, respectively in triticale). But in wheat starch they were (0.22, 0.71and 77.25%, respectively). On the other hand (ether extract and amylose) in triticale starch were (0.1 and 23.75%, respectively) which were higher than those in wheat starch (0.09 and 22.75%, respectively).



a) Triticale Starch Granules.



Wheat Starch Granules.

ʾig. (3): Picture of Starch of Wheat and Triticale Granules was Magnified 1000 X .

Technological Properties of Flour.

From table (8) it is obvious that the wet gluten of triticale and wheat flours were (22.80% and 38.8%, respectively). While dry glutens were (8.45% and 12.95%, respectively). The protein content of glutenin triticale was 81.02% which was lower than that in wheat flour 84.70%. The sedimentation value in wheat flour was higher than that in the triticale flour it was (28.78Cm^3) in wheat flour, but in triticale flour it was (18.06 Cm^3) on dry basis. The sedimentation value was lower in triticale flour than that in wheat flour it may be due to the triticale flour had a weaker gluten net work than that in wheat flour and the starch

Table (8): Technological properties of triticale amid wheat flours.

Test value.	Triticale flour.	Wheat flour.
Wet gluten net work.	22.8%	38.8%
Dry gluten net work.	8.45%	12.95%
Water cabacity of gluten.	63.1%	66.7%
Gluten protein content.	81.02%	84.7%
Sedementation test.	18.06 Cm^3	28.78 Cm^3

granules it was eroded result the highty of α-amylase activity in triticale. So that the sedimentation value in wheat flour higher than that in triticale flour. Because the sedimentation value depending on the protein content, strength of gluten net work, moisture in sample, damaged starch granule content and lactic acid concentrate and content of starch in flour-lactic acid suspension as reported by **Zelleny *et al.* (1971).**

Flour Granulation.

Data recorded in table (9) indicate the percentage of each

Table (9): Percentages of different particles size in triticale and wheat flours and their blends.

Save No.	1	2	3	4	5
1	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00
3	1.00	1.14	1.11	1.10	1.04
4	12.78	17.17	16.10	14.98	13.88
5	14.90	14.33	14.47	14.62	14.76
6	31.96	33.57	33.17	32.77	32.4
7	39.50	34.58	35.81	37.00	38.27

1. Triticale flour.
2. Wheat flour.
3. (25% Triticale + 75% Wheat) blend.
4. (50% Triticale + 50% Wheat) blend.
5. (75% Triticale + 25% Wheat) blend.

flour particles size in wheat and triticale flours . ther was no residue of flour on the first and second sieves, but on the 3 rd. sieve, it was (1%) of triticale flour and (1.14%) of wheat flour.

Other residues on sieves Nos. (4, 5, 6 and 7) in triticale flour were (12.78%, 14.90%, 31.96% and 39.50%, respectively), were in wheat flour they were (17.17%, 14.33%, 33.57% and 34.58%, respectively). From these results it may be concluded that small particles in triticale flour were higher than those of wheat flour, while coarse particles in triticale flour were lower than their counterparts in wheat flour because the coarss particles increase in percent as the hardness of grain endosperm is increase. By increasing the content of wheat flour in the blend decreased the fine particles in it.

Rheological Properties of Dough .

Farinograph properties.

Concerning dough rheology it is well known that the farinograph parameters indicate the most important properties in this dough.

Farinograph infomations were presented in table (10) and in figures (4, 5) for triticale flour dough and wheat flour dough. The water absorption percentage was high for wheat flour dough 65.4% but it was lower for triticale flour dough 62.6%. Arrival time in wheat flour dough was higher (2.1 min.) than that of triticale flour dough (0.8 min.) therefore the mixing time for wheat flour dough compared to triticale flour dough was (2.7min.) for wheat flour dough but it was (1.2 min.) for triticale flour dough, the stability time value was higher for wheat flour dough than that of triticale flour dough (1.6 min. and 0.7 min. respectively). The mixing tolerance index were different between wheat flour dough and triticale flour dough it value was (70B.U.) in wheat flour dough and (205 B.U.) in triticale flour dough. Thus the weakening value in wheat flour dough was (100 B.U.) but it was (250 B.U.) in triticale flour dough.

Table (10): Farinograph properties of triticale, wheat, and (triticale-wheat) flours blends.

Sample No.	Water absorption. %	Arrival time (min.)	Mixing time (min.)	Stability time (min.)	Mixing tolerance index (B.U.)	Weakning of dough (B.U.)
1	65.4	2.1	2.7	1.6	70	100
2	64.4	1.5	2.3	2.3	105	145
3	64.0	1.2	1.9	1.5	135	180
4	63.1	1.0	1.5	1.1	160	220
5	62.6	0.8	1.2	0.7	205	250
6	62.8	0.7	3.5	4.5	130	230
7	63.2	0.6	2.5	3.5	135	230

1. Wheat flour dogh.
2. (75% Wheat + 25% Triticale) blended dough.
3. (75% Wheat + 25% Triticale) blended dough.
4. (75% Wheat + 25% Triticale) blended dough.
5. Triticale flour dogh.
6. (1 : 1) blended dough + 5% dextrin.
7. (1 : 1) blended dough + 10% dextrin.

Triticale flour addition which caused to decrease hydrogen bonds formed trough water molecules entangled within the gluten polypeptide chains into a net work so that the dough was formed in shorter period, shorter developing time, shorter stability time and high mixing tolerance index and weakening of dough .

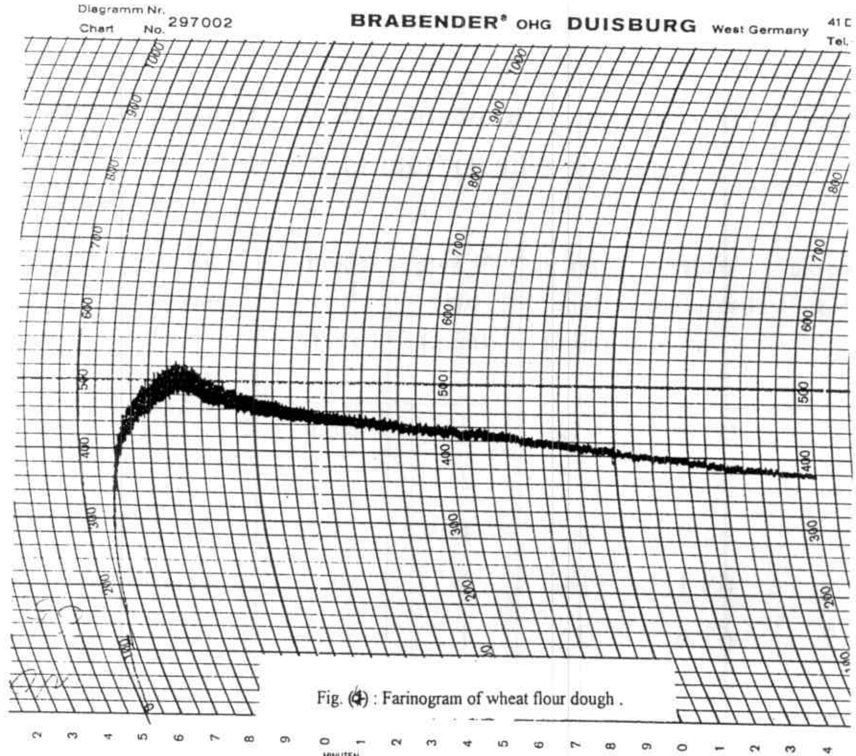


Fig. (4) : Farinogram of wheat flour dough .

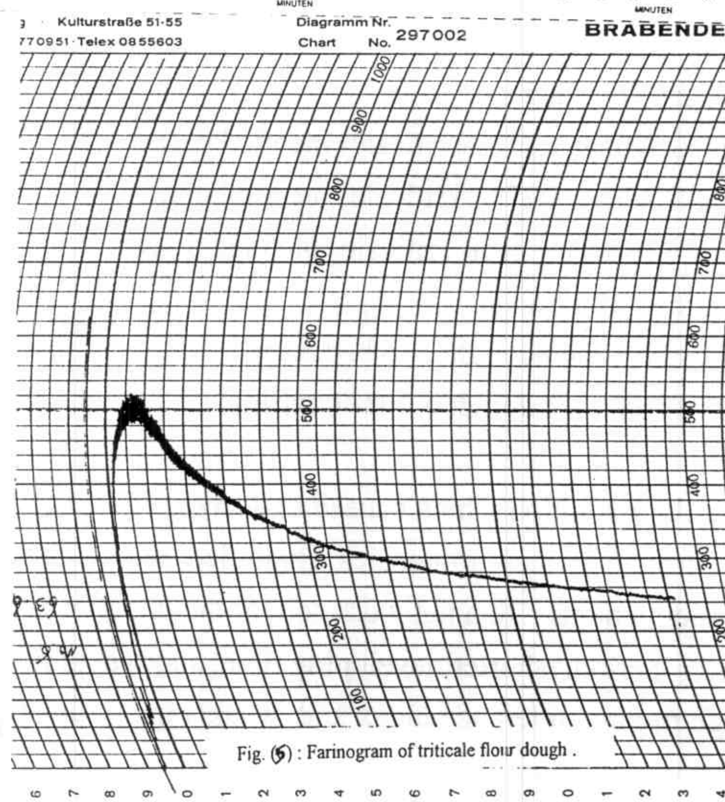


Fig. (5) : Farinogram of triticale flour dough .

In table (10) and figures (6, 7, 8) it is clear in (wheat-triticale) flour blends (water absorption, arrival time, mixing time, stability time) increase as the percent of wheat in blended dough. By increased wheat flour in the blend to 25% was (63.10%, 1.00 min., 1.50 min. and 1.10 min., respectively). At 75% percent of wheat flour in the blend they were (64.40%, 1.50 min., 2.30 min. and 2.30 min., respectively).

Concerning weakening of dough and mixing tolerance index. It is clear that they were decrease as the percent of wheat in the blended dough at 25% wheat flour (weakening dough and mixing tolerance index) it was (220 B.U. and 160 B.U., respectively). while at 75% wheat it was (145 B.U. and 150B.U., respectively) it may be due to the reinforcing effect of wheat in blended dough is interpreted by the higher gluten strength of wheat in comparison with the fragile gluten strength of triticale.

On the other hand it is clear from data represented in table (10) water absorption that increase as the percent of wheat in the blended dough. That may be due to the increasing in hydrogen bands formation due to the increase in gliadin fraction of the dough.

From data in table (10) and figures (9, 10) it is clear the effect of dextrin addition to 50% blended dough decreased water absorption. Because of its hygroscope nature. which tend to break some of the hydrogen bonds and absorb water molecules.

This is clear from the results where 50% blended dough gave 64.0% water absorption while addition of 5% dextrin gave 62.8%. This behavior was elucidated by lower arrival time in

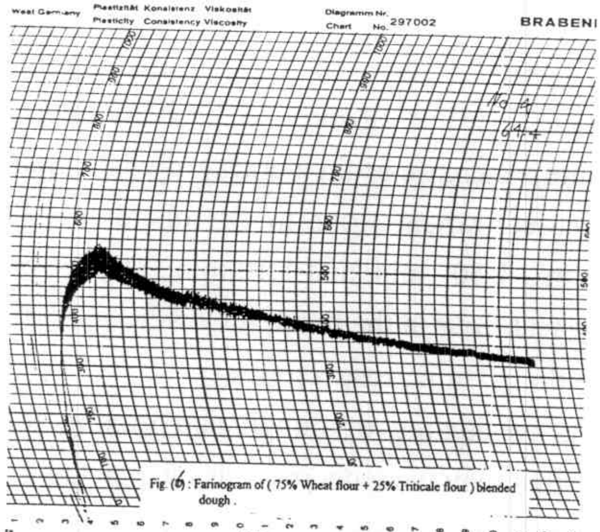


Fig. (6) : Farinogram of (75% Wheat flour + 25% Triticale flour) blended dough .

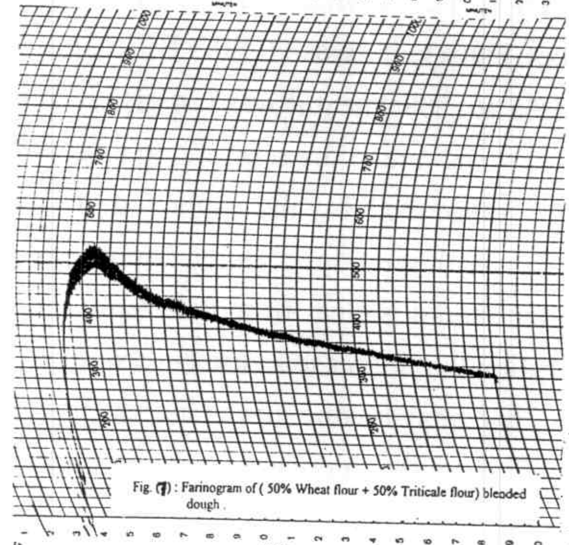


Fig. (7) : Farinogram of (50% Wheat flour + 50% Triticale flour) blended dough .

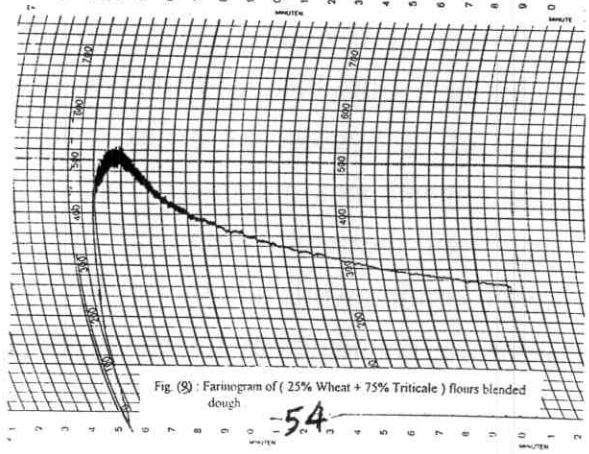


Fig. (8) : Farinogram of (25% Wheat + 75% Triticale) flours blended dough

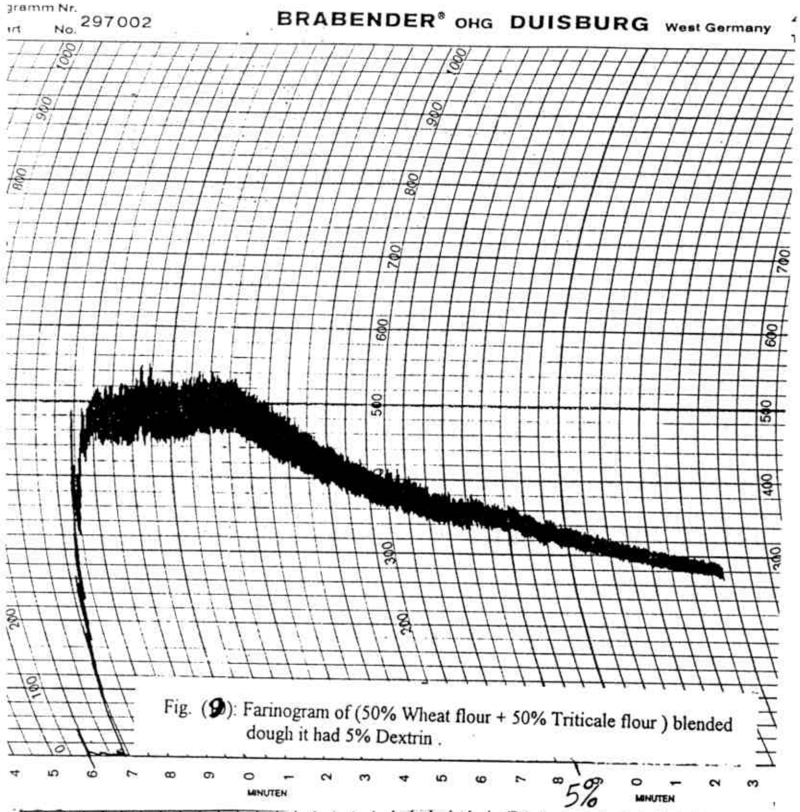


Fig. (9): Farinogram of (50% Wheat flour + 50% Triticale flour) blended dough it had 5% Dextrin .

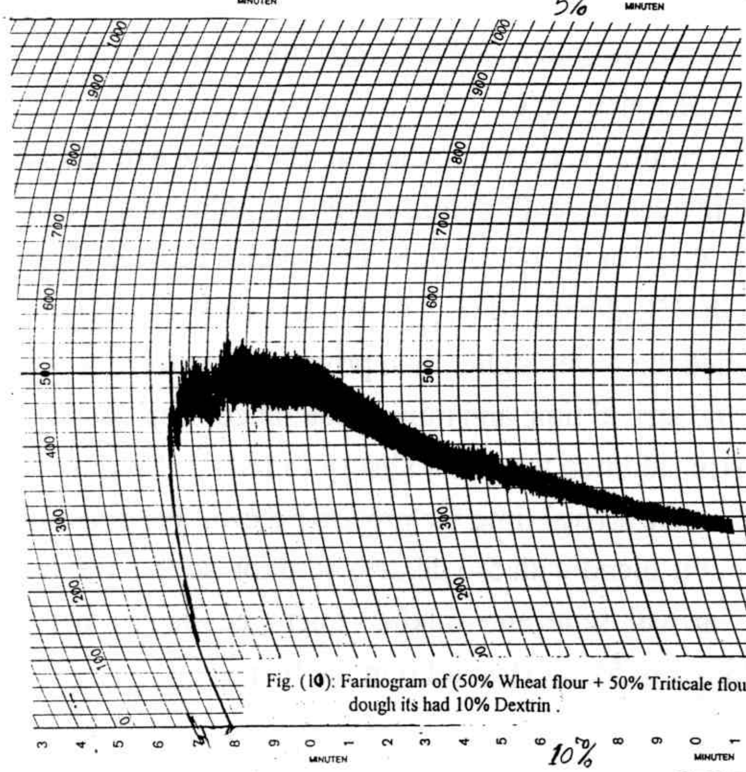


Fig. (10): Farinogram of (50% Wheat flour + 50% Triticale flour) blended dough its had 10% Dextrin .

50% blended dough 1.2 min. became 0.7 min. when 5% dextrin was added. But mixing time and stability time were increased from (1.9 min. and 1.5 min., respectively) to (3.5 min. and 4.5min., respectively). The decrease in arrival time may be due to the release of water from gliadin fraction due to the dissociation of hydrogen bonds. While the increase in mixing time and stability time is due to the mascking of gliadin fraction and the appearance of glutenin fraction functionally only.

Therefore the resistance to extension is increased. This role is only an appearant role because there is no a real dough strength but in reality the weakening of dough and mixing tolerance index is considerably increased from (180 B.U., 135B.U., respectively) to (230 B.U. and 130 B.U., respectively).

As a result of adding 5% dextrin. The same trend by 10% dextrin addition was increased the water absorption arrival time and mixing tolerance index their values were 63.2%, 0.6 min., and 135B.U., respectively) while the (mixing time and stability time) were increased to (2.5 min. and 3.5 min., respectively) higher than those in the blend with zero dextrin ratio. and lower than those in 5% dextrin ratio. it may be due to dextrin in 5% percent binded the water higher than proteins therefore the water absorption and arrival time and mixing tolerance was lower but in 10% dextrin addition the water absorption it was become very higher and in the arrival time the protein percent become lower than those in the blend with 5% dextrin addition so that the water absorption, arrival time and mixing tolerance index) become lower than those in 5% dextrin ratio in the blend.

Extinsograph Properties.

Differences in extinsograph parameters for the triticale and wheat variety Sakha 69 are shown in table (11) and figures (11,12) (extensibility, energy, proportional number, extensibility at maximum resistance to extension value and oxy number) in wheat flour dough were higher than those of triticale flour dough. They were (162 mm., 580 B.U., 95.5Cm^2, 3.3, 138 mm. and 2.67, respectively in wheat flour dough) while in triticale flour dough it was (132 mm., 130 B.U., 19.5Cm^2, 0.9, 80 mm. and 1.98, respectively). The proportional number is known from the data in table (11) it was found that there is a negative relationship between the extensibility of the dough and the proportional number this means that extensibility is increased beyond certain limits the proportional number is lowered.

Resistance to extension was found to be highly positively correlated to energy, this clearly indicates that the non polar fractions of the protein is responsible for the skeleton structure of the net work that gives dough the gas retention property.

Therefore the resistance to extension is increased to certain limits it mean improved the dough quality it was found the relation between proportional number and energy, the proportional number increased with energy increasing like that the oxy number in positive relation with the extensibility because the function of the polar fractions of triticale proteins it was high ability to reacting with oxygen of air and exchange the disulfide bonds to sulfahydrel gropes. and the relation between the proportional number and energy its highly positively correlated it may be due to the energy and proportional number it was increased to certain limits.

Table (11): Extensograph properties of triticale, wheat and (triticale – wheat) flour blends dough.

Sample	Resistant to extension (B.U.)	Extensibility (Min.)	Proportional Number	Energy Cm^2	Max. Extensibilty (mm.)	Oxy Number
1	580	162	3.3	95.5	138	2.67
2	440	174	2.5	77	130	3.05
3	350	156	2.2	57	118	2.54
4	210	155	1.3	40.2	114	2.97
5	130	132	0.9	19.5	80	1.98
6	505	152	3.3	81	111	2.44
7	420	127	3.4	75	82	2.27

1) wheat flour dough.

2) (75% wheat + 25% triticale) blend dough.

3) (50% wheat + 50% triticale) blend dough.

4) (25% wheat + 75% triticale) blend dough.

5) Triticale flour dough.

6) (1 : 1) blended dough + 5% dextrin.

7) (1 : 1) blended dough + 10% dextrin.

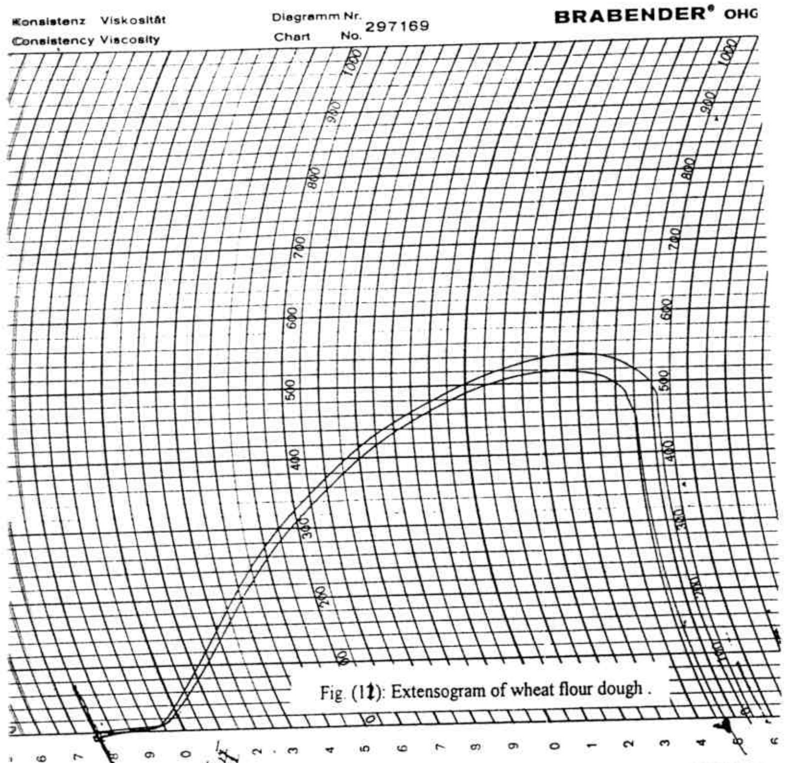


Fig. (11): Extensogram of wheat flour dough .

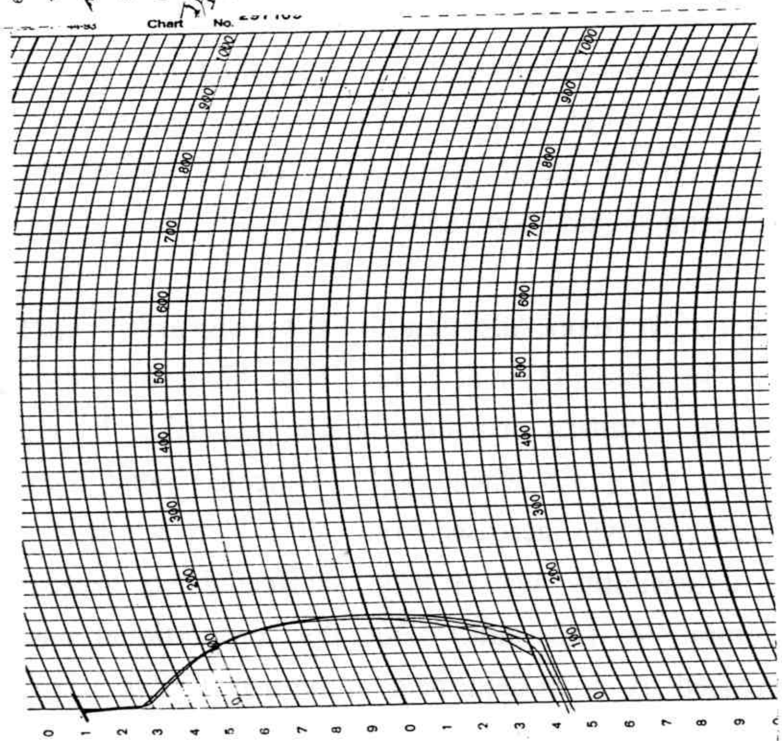


Fig. (12): Extensogram of triticale flour dough .

Figures (13, 14, 15) explain in the blends, by increase of triticale flour percent in the blended dough resulted in the decrease of the resistance to extension, extensibility, proportional number, energy, Extensibility at maximum resistance to extension value and oxy number their was in the blend its contained 25% triticale flour were (440 B.U., 174 mm., 2.5, 77 Cm^2, 130 mm. and 3.05 respectively) while in the blend had 50% triticale flour were (350 B.U. , 156 mm. , 2.2, 57 Cm^2 , 118 mm. and 2.54, respectively). and in the blend had 75% triticale flour the values were (210 B.U.,155 mm., 1.3, 40.2 Cm^2, 114 mm. and 2.97, respectively).

This behavior indicates the same trend in dough rheology where wheat gluten functions as the other dough constituents within the dimensions of this net work the functioning properties of gliadin and glutenin (extensibility and resistance to extension) appear on the starch granules together with different chemical, non chemical and cooperation bonds.

Effect of Dextrine Addition on Eextensograph Properties.

In table (11) and figures (16, 17) data for the effects of dextrine addition on extensograph properties. by adding 5% dextrine for (50% wheat + 50% triticale) blend, the resistance to extension was increased from 350 B.U. to 505 B.U. otherwise the extensibility was nearly unaffected its decreased from (156mm. to 152 mm.). But the proportional number was increased by 5 % dextrine addition from (2.2 to 3.3). While the energy was increased from (57 Cm^2 to 81 Cm^2) reflected the extensibility to maximum resistance to extension and oxy number they decreased from (118 mm. to 111mm. and 2.54 to

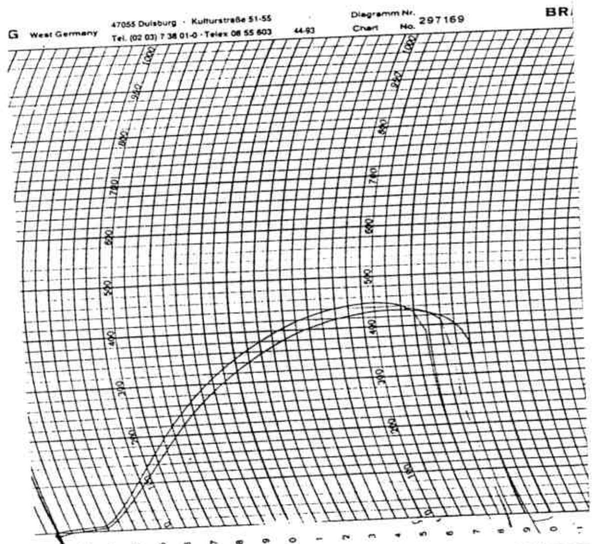


Fig (13) Extensogram of (75% Wheat flour+25% Triticale flour) blended dough .

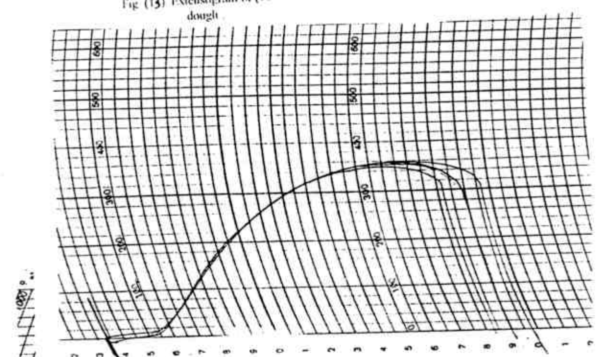


Fig (14) Extensogram of (50% Wheat flour+50% Triticale flour) blended dough

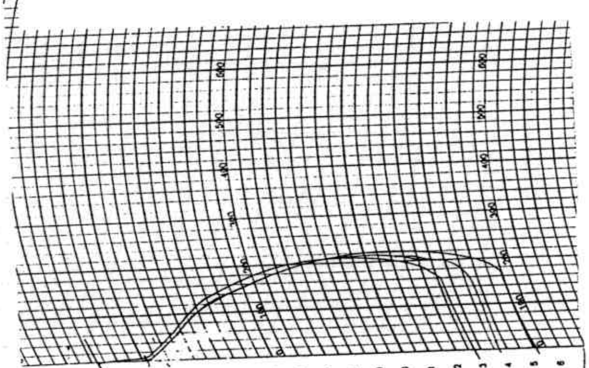


Fig (15): Extensogram of (25% Wheat flour+75% Triticale flour) blended dough .

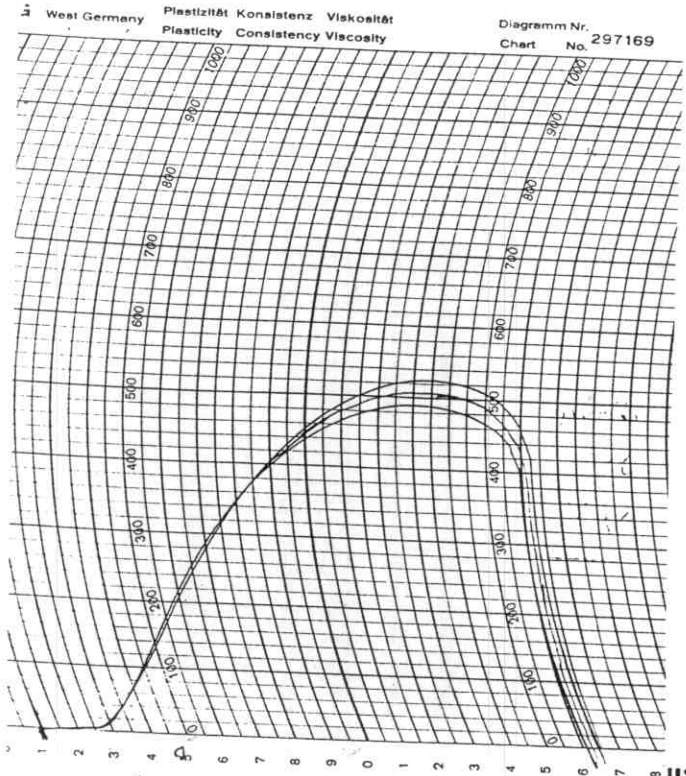


Fig. (16): Extensogram of (50% Wheat flour+50% Triticale flour) blended dough its had 5% Dextrin .

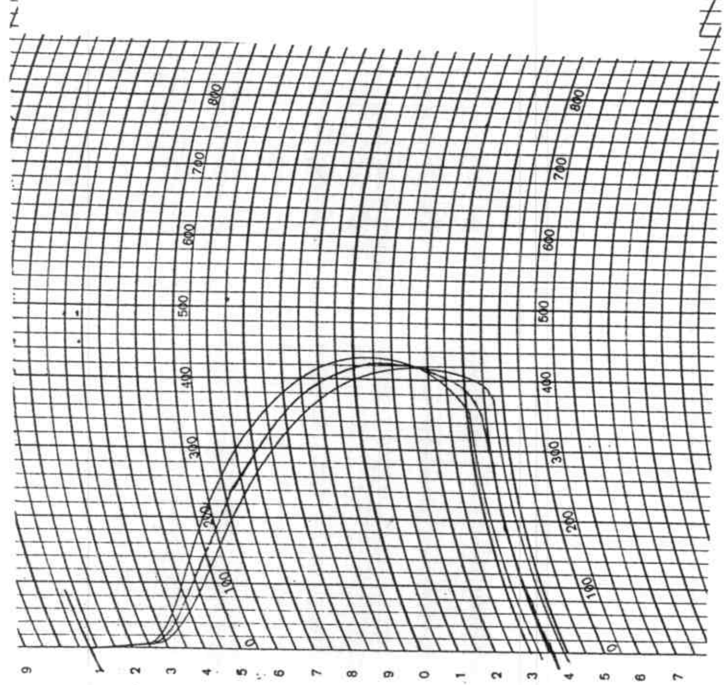


Fig. (17): Extensogram of (50% Wheat flour+50% Triticale flour) blended dough it had 10% Dextrin .

50C° in wheat flour than those of triticale flour. Figures (18, 19) and in table (12) clear the triticale starch was higher than wheat starch in (maximum viscosity, temperature at maximum viscosity and viscosity at 95 C°) the values in triticale were (535B.U., 94.5 C° and 520 B.U., respectively) but in wheat they were (465 B.U., 93 C° and 495 B.U., respectively). But triticale starch was lower than wheat starch in properties of (transition point, viscosity at 50 C° and set-back point) it was in triticale (75C°, 1115 B.U. and 580 B.U., respectively) but those in wheat

Table (12): Amylograph properties of triticale and wheat starchs.

Sample	Transition point (C°)	Maximum viscosity (B. U)	Temperature at maximum viscosity (C°)	Viscosity at 95°C (B. U.)	Viscosity at 50°C (B. U.)	Set-bak point (B. U.)
cale starch	75.00	535	94.50	520	1115	580
at starch	78.00	465	93.00	495	1140	675

were (78C°, 1140 B.U. and 675 B.U., respectively) it may be due to the amount of hydrogen bonds in triticale starch molecule lower than that in wheat starch molecule so that the triticale starch need to low temperature to transition to gel case than wheat starch. Also the amylase activity in triticale its higher than that in wheat it's cause degradation in amylase and amylopectin chains produced different kinds of dextrins had low viscosity. Therefore the viscosity at 50C° and set-back point in triticale lower than that in wheat starch in (Maximum viscosity and

2.44, respectively). this behavior may be due to the dextrin had high hygroscopeic nature which tends the water to break some hydrogen bonds between water molecules and gliadin fraction therefore the gluten proteins was maked-up gluten net work had lower capacity of hydrogen bonds with fragile structure of dough in the blends.

Thereby maked abnormal gluten net work had less extensibility high resistance to extension so that the dough had energy, high proportional number. But when added 10% dextrin relative to the blend had more pronounced effect in the same above mentioned trend it was absorbed higher quantity of water and maked-up lower quantities of hydrogen bonds so that the properties of gluten net work were unsignificant higher resistance to extension, significant lower extensibility therefore the proportional number become higher and the energy value become slightly higher than that in the blend had zero dextrin ratio. the resistance to extension, extensibility, proportional number, energy, extensibility at maximum extension and oxy number were (420 B.U., 127 mm., 3.4, 75 Cm2, 82 mm. and 2.27, respectively in the blend had 10% dextrin).

Amylograph Properties .

The triticale flour exhibited low amylograph viscosity than wheat flour as reported by **Berry *et al.* (1971), Lorenz (1972) and (Klassen *et al.* (1971)** was related to high α-amylase activity the change temperature, temperature at maximum viscosity, maximum viscosity, viscosity after fixing the temperature at 95 C^{o} for 10 min. and viscosity after cooling to

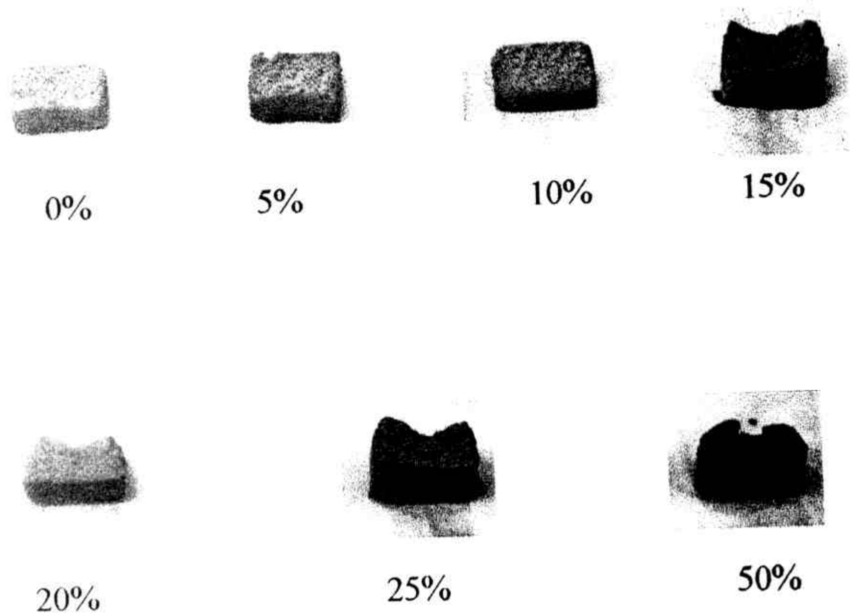


Fig (21): Effect of the dextrin addition on cake properties in ratios 5, 10, 15, 20, 25 and 50%.

happened rapidly because the water activity and P^H and all conditions were suitable for fungi active. In table (13) the average of organoliptic tests and L.S.D. for the cake properties it was maked from wheat flour with (zero, 5, 10, 15, 20, 25 and 50% dextrin ratio in the formula).

Table (13): The mean of organolyptic test for cake made from wheat flour with dextrin addition in (zero, 5, 10, 15, 20, 25 and 50%).

Dextrin ratio %	Flavour 10	Color 10	Structur 46	Texture 34	General accebtance
Zero	9.71	9.57	42.7	33.42	95.4
5	9.14	8.86	42.14	31.14	91.28
10	9.07	8.29	41.71	30.86	89.93
15	8.29	7.57	39.57	28.28	83.71
20	8.29	7.57	39.57	27.15	82.58
25	8.42	7.29	38.86	26.43	81.00
50	4.7	zero	5.4	4.3	14.40
L. S. D At 1%	1.577	1.453	2.559	93.725	

It's clear from data in table (14) and figure (21) the means of scores of the panel test for cake made from wheat flour, triticale flour or (triticale-wheat) flours blends without emulsifier

Table (14): Average of panel test scores for cake made from triticale, wheat and their blends without emulsifiers.

Sample	Flavour 10	Color 10	Structure 46	Texture 34	General accebtance
1	9.97	9.22	42.58	33.50	91.27
2	9.94	9.11	42.07	33.00	90.12
3	9.68	9.39	41.20	33.50	89.77
4	9.77	9.56	40.65	33.50	89.48
5	9.90	9.89	38.53	33.5	87.82
L. S. D at 1%	0.945	0.805	0.797	0.875	

1) Cake of wheat.

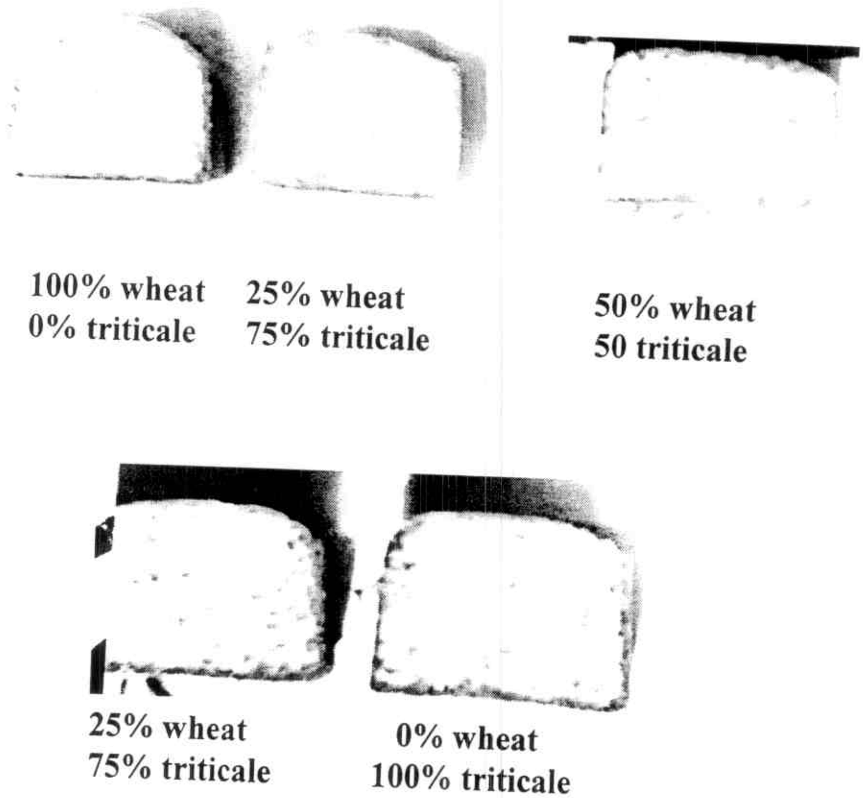
2) Cake of (75% wheat + 25% triticale).

3) Cake of (50% wheat + 50% triticale).

4) Cake of (25% wheat +75% triticale).

5) Cake of Triticale.

agents it's indicated that most cake which were produced from pure triticale flour had score slightly less than cake produced from (triticale-wheat) flours blends less than cake produced from pure wheat flour.



Fig(21): Cake made from wheat flour, triticale flour or their flour blends without emulsefiers.

Data in table (15) and figure (22) in its clear scores of cake was made from wheat flour, triticale flour and their blends with 1% Glecried Mono Stearate (G.M.S.) as emulsifier agent.

Table (15): The mean of panel test scores for cake made from triticale, wheat, and their blends with 1% G.M.S.

Sample	Flavour 10	Color 10	Structure 46	Texture 34	General accebtance
1	9.97	9.1	45.00	34	96.07
2	9.94	9.00	45.00	33.5	95.41
3	9.68	9.22	45.10	33.5	95.55
4	9.77	9.20	45.15	33.6	95.71
5	9.8	9.25	45.00	33.6	95.68
L. S. D. at 1%	0.902	0.935	0.989	0.933	

1) Cake of wheat.
2) Cake of (75% wheat + 25% triticale).
3) Cake of (50% wheat + 50% triticale).
4) Cake of (25% wheat + 75% triticale).
5) Cake of Triticale.

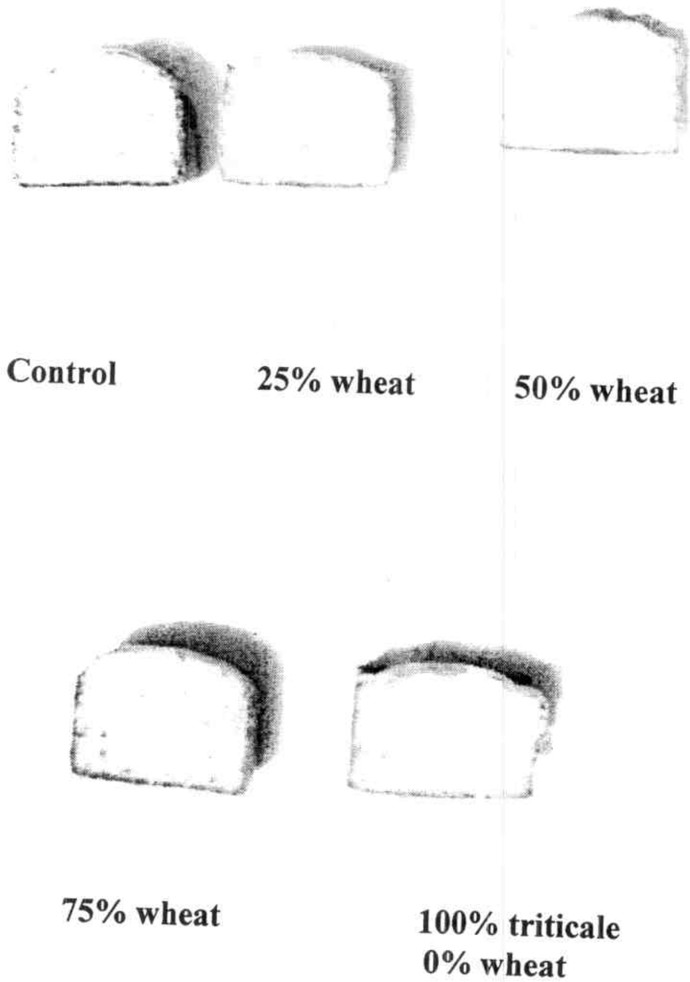


Fig.(22): Cake make from wheat flour, triticale flour or their flou blends with 1% emulsefier agent of G.M.S. (glecried mo stearat.

The results indicated that most cake which were produced from wheat flour, triticale flour and their blends with emulsifier had the same score of the cake were produced from pure wheat flour. The cake was made from wheat flour it was staled faster than that were made from triticale flour faster than that were made from their blends, because the triticale had higher contents of small size particles of flour than that in wheat flour and the starch granules of triticale flour it was smaller than that in wheat starch and the amylose content in starch of triticale was higher than that in wheat starch and the ∝-amylase activity generally in triticale higher than that in wheat cause increasing in dextrins content in flour so that the water absorption in the bread dough must be decreased to compensate for the higher ∝-amylase activity. The must be decreased to compensate for the higher ∝-amylase activity, the high ∝-amylase activity will dextrinize greater than optimal content in the starch during cake processing. Thereby reducing its water-binding capacity and ultimately affecting the crumb structure of cake and it's become slow staling rate therefore the cake from triticale it had high water-binding capacity and it had farther shelf life than that from triticale flour. (Triticale-wheat) blends had higher protein and dextrin contents therefore capacity of water-binding become great its caused break the hydrogen bonds and the hydrogen bonds were formed between (amylose-amylose), (amylose-amylopectin) and (amylopectin-amylopectin) chains was decreased. Clear from data in table (16) and figure (23) by dextrin addition the score of organoliptic test it was slightly decreased but the shelf life of cake become longer at 5% dextrin were added than cake of (triticale-wheat) flours blends without dextrin but in 10 % dextrin addition the water quantity was binded become larger so that the cake crumb become gummy and the moisture percent become higher therefore the fungi were grown and caused spoilage and the structure become fragile and the crumb color become darker than those in cake made from blends without dextrin. While cake were made of wheat flour,

Table (16): Average of panel test scores for cake made from (1 : 1) blend, (1 : 1) blend had 1% G. M. S. (1 :1) blend had 1% G. M. S. + 5% dextrin and (1 : 1) blend had 5% dextrin.

Sample	Flavour 10	Color 10	Structure 46	Texture 34	General accebtance
1	9.68	9.11	41.20	33.50	89.77
2	9.70	10.00	38.95	34.00	88.65
3	9.40	9.61	38.35	33.00	86.36
4	9.50	9.39	38.25	33.00	86.24
L. S. D at 1%	0.960	0.877	0.815	0.901	

1) Cake of (50% triticale + 50% wheat) blend.

2) Cake of (1 : 1) blend + 1% G. M. S.

3) Cake of (1 : 1) blend + 1% G. M. S. + 5% dextrin.

4) Cake of (1 : 1) blend + 5% dextrin.

50% triticale
50% wheat
5% dextrine

50% triticale
50% wheat

50% triticale
50% wheat
1% G.M.S.

50% triticale
50% wheat
5% dextrine + 1% G.M.S.

Fig(23): Cake made from wheat flour, triticale flour or their flour blends with 1% G.M.S., 5% dextrine or (5%dextrine + 1% G.M.S.).

triticale flour and their blends with 1% G.M.S. relative to flour had shelf life period longer than that in cake were made without emulsifiers it may be due to the G.M.S. formed the (Lipids-Amylose complex) it was in helical form therefore the amount of amylopectin were retrograded and the hydrogen bonds their are become less so that the staling rate become slowly because in the streat chains of polysaccharides (amylose) it's forming great amount of hydrogen bonds but in helicale form the content of hydrogen bonds were formed was decreased therefore the staling rate become low so that must be exchange the streat form to helical form by maked-up emulsifier agents) figure (24). **Batres and White (1986), Krog (1971), Krog and Jenssen (1970) and Lagendij and Pennings (1970).**

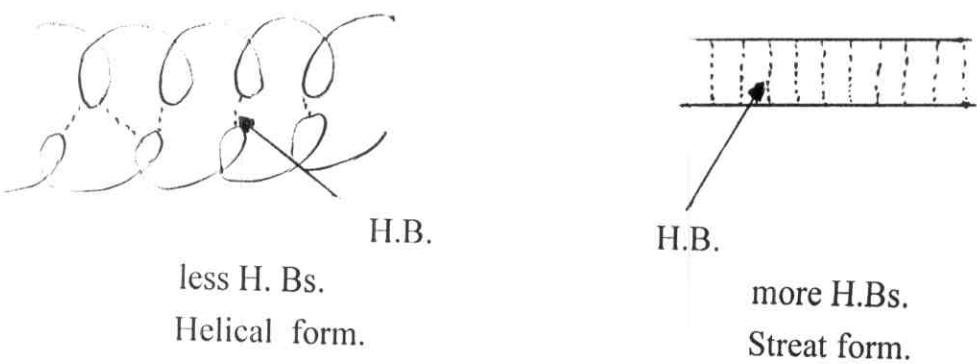


Fig. (24).

Cake made from wheat flour, triticale flour or (triticale-wheat) flours blends without emulsifier agents indicated that most cake of pure triticale flour had score slightly less than cake of (triticale-wheat) flours blends higher than cake produced from pure wheat flour.

Activity of enzyme deastase was affected by staling degree by storage and increasing staling degree the reducing sugars as maltose were produced as result the action of deastase on starch become low.

From data in table (17) and figures (25-32) it's explained difference in staling rate the quantity of reducing sugars as maltose from cake after digestion by deastase after (6, 24, 48, 72, 96, 120, 144, 168 and 192 hrs.). It's clear in cake were made from wheat flour the staling become complete after (120 hrs.) so the reducing sugars quantity after 6 hrs. from baking

Table (17): effect of staling of cake on diastase activity.

Period of storge in hrs.	Total reducing sugars as maltose test mg/10gm cake							
	1	2	3	4	5	6	7	8
Cake stored for 6hrs.	402.00	403.15	397.81	389.88	395.00	399.3	1506.0	1516.0
Cake stored for 24 hrs.	377.20	378.19	373.40	366.30	370.90	374.77	1216.8	1379.8
Cake stored for 48 hrs.	325.70	326.45	322.79	317.30	320.85	260.15	1090.0	1096.9
Cake stored for 72 hrs.	261.31	261.80	259.49	206.06	258.30	209.90	739.00	743.33
Cake stored for 96 hrs.	210.49	210.73	209.55	207.75	208.88	179.39	461.90	464.17
Cake stored for 120 hrs.	210.49	179.80	179.25	178.45	178.95	164.10	293.90	295.00
Cake stored for 144 hrs.		179.75	164.10	165.10	164.00	158.00	217.61	210.40
Cake stored for 168 hrs.			164.20	165.10	164.01	158.00	182.92	176.55
Cake stored for 192 hrs.							182.92	176.55

1) Cake of wheat.
2) Cake of triticale.
3) Cake of (25% wheat + 75% triticale) blend.
4) Cake of (75% wheat + 50% triticale) blend.
5) Cake of (50% wheat + 50% triticale) blend.
6) Cake of [(1 : 1) blend + 1% G. M. S.].
7) Cake of [(1 : 1) blend + 5% dextrin].
8) Cake of [(1 : 1) blend + 1% G. M. S. + 5% dextrin].

it's (402.00 mg/10 gm. cake) and after (120 hrs.) it's (210.49 mg/10 gm. cake) and in cake were made from triticale flour the staling become complete after (144 hrs.). Therefore the reducing sugars was decreased from (403.15 to 179.8 mg /10 gm. cake) after (6 to 168 hrs. respectively from baking). When treated the fresh cake were made from (1 : 1) blend with deastase it's gave reducing sugars (395.0 mg/10 gm. cake) after 6 hrs. from baking while the cake which treated after 168 hrs. from baking the enzyme reaction was very weak and gave only about (164.0 mg /10g of cake) of reducing sugars as maltose and the cake stored for 192 hrs. after baking gave the same above value. But in cake were made from the blend had 5% dextrin the fresh cake when treated with deastase (1 gm. cake slurred in 100ml. distilled water treated with 4000 unit of the enzyme for 5 mins. at 30 C°) gave reducing sugars of (1506.00mg/10 gm. cake) when cake was stored for 192 hrs. after baking its gave only about (182.92 mg./10 gm. cake) of reducing sugars and the cake was stored for 216 hrs. after baking gave the same above value, and the cake had 1% G.M.S. and 5% dextrin the fresh cake gave reducing sugars of (1516.00 mg/10gm cake) when cake was stored for 192 hrs. after baking the enzyme reaction was very weak and it gave only about 176.55 mg/10 gm. cake of reducing sugars as maltose and the cake was stored for 192 hrs. after baking gave the same above value .

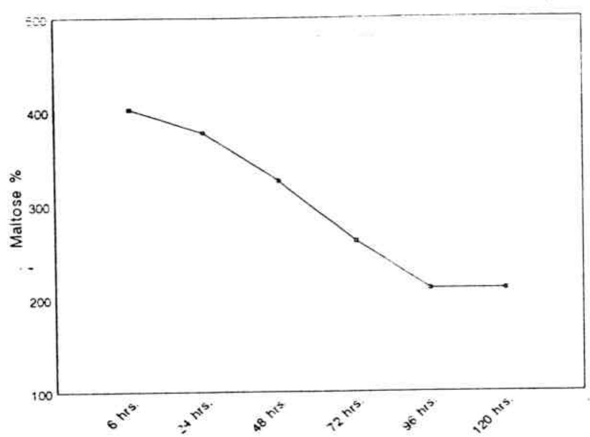


Fig. (26) Cake from 100 % Wheat

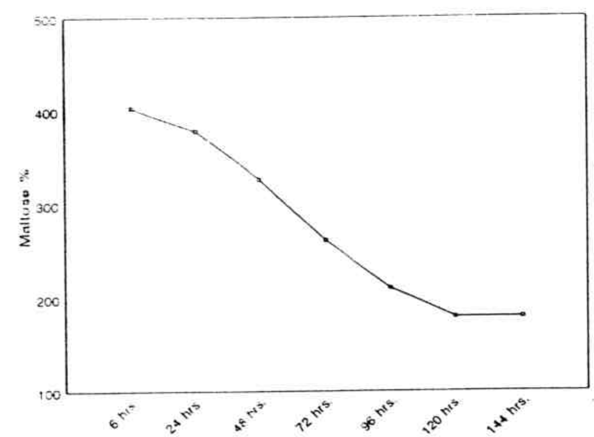


Fig. (27) Cake from 100% Triticale flour

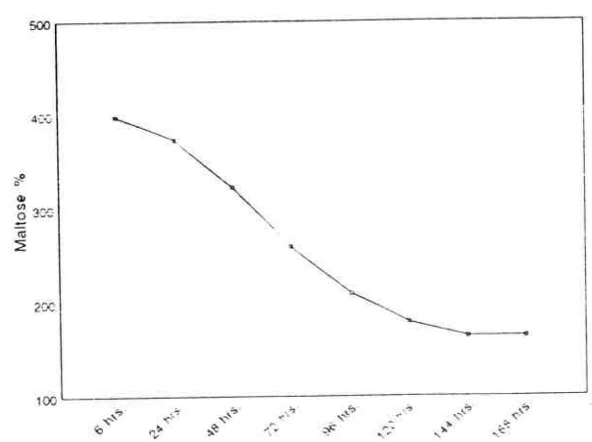


Fig. (28) Cake of 25 % Wheat flour + 75 % Triticale flour blend

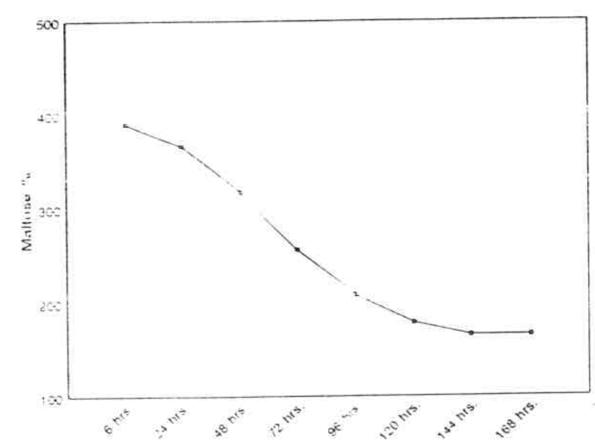


Fig. [illegible] Cake of 75 % Wheat flour + 25 % Triticale flour blend

Fig. (25, 26, 27 & 28): Effect of staling rate on diastase activity in different blends.

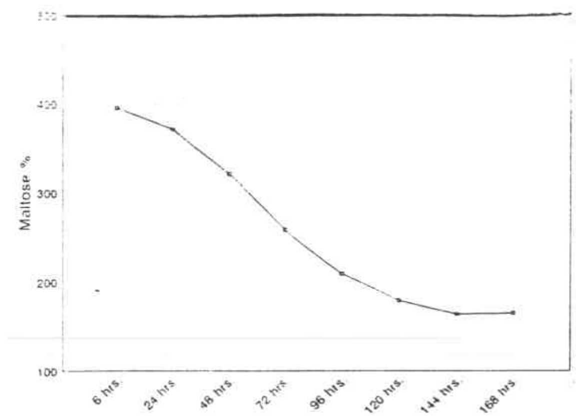


Fig. (30) Cake of(50% Wheat flour + 50% Triticale flour) blend.

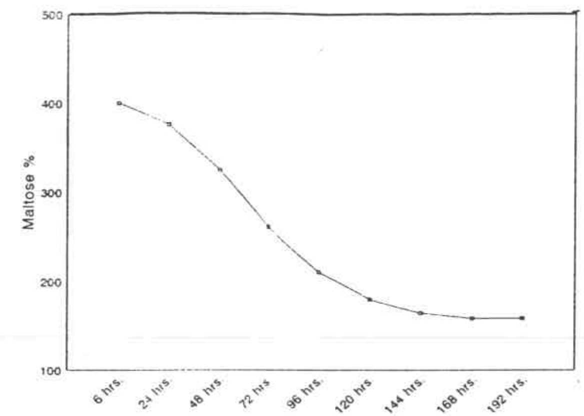


Fig. (31) Cake of (50% Wheat flour + 50% Triticale flour) blend with 1% G.M.S.

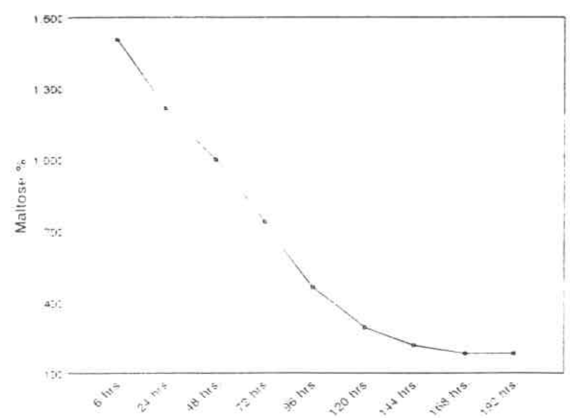


Fig. (32) Cake of (50% Wheat flour + 50% Triticale flour) blend with 5% Dextrin

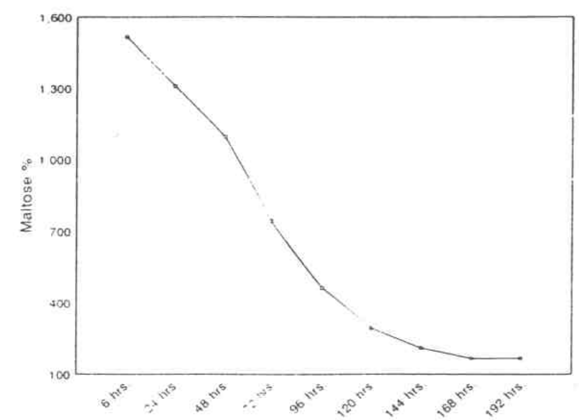


Fig (33) (50% Wheat + 50% Triticale) blend with G.M.S. + 5% Dextrin

Fig. (29, 30, 31 & 32): Effect of staling rate on diastase activity in different blends.

Data in table (18) exhibited calories value it was produced from digestion of 100 mgs. of dry cake was produced from triticale flour, wheat flour or their blends by 1% G.M.S. or without G.M.S. . The cakes with 1% G.M.S. hadn't significant defferences in calories, the calories it's ranged from 475 cal. to 478.28 cal.

In cakes of triticale flour, wheat flour or their blends without G.M.S. the calories values ranged from (474.29-4773 cal. /100 gm. cake) on dry basis. Also table (18) involved the data of calories for cake were made from the blend had 50% triticale flour and 50% wheat flour with 1% G.M.S. relative to flour, the blend had 5% dextrin and the blend had 5% dextrin and 1% G.M.S. was gave (475.5, 477.6 and 477.5 cal./100 gm. respectively).

Finally it may be concluded that the optimum (wheat-triticale) flour blends for producing cake it had good quality properties it was (1 : 1) blend it had 1% G.M.S. and 5% dextrin.

The product from this blend had long shelf life period, good flavour, good structur, best (crust & crumb) color. By dring the products at (70-100 C^{o}) shelf life period become long, good commercial properties and best organoliptic properties.

Table (18): The calories produced from digeastion of 100 grams of cake were produced from this blends.

Sample	Ash %	Fibers %	Crude protein %	Crude fat %	Total charbohrydrate %	Total calories cal/ 100 gm
1	2.05	0.10	11.20	15.00	73.80	475.00
2	2.20	0.08	11.03	15.12	74.00	476.20
3	1.99	0.09	10.80	15.01	74.00	474.29
4	2.11	0.10	11.01	15.50	73.70	478.34
5	2.17	0.12	11.40	15.30	73.50	477.30
6	2.00	0.08	11.40	15.40	73.00	476.60
7	2.11	0.08	10.97	15.60	73.50	478.28
8	2.07	0.085	10.90	15.30	73.75	476.30
9	2.05	0.85	10.90	15.00	74.10	475.00
10	2.06	0.10	11.10	15.10	73.70	475.10
11	2.08	0.08	10.85	15.45	73.80	477.65
12	2.07	0.08	10.70	15.40	74.00	477.40

1) Cake of wheat.
2) Cake of (75% wheat + 25% triticale).
3) Cake of (50% wheat + 50% triticale).
4) Cke (25% wheat + 75% triticale).
5) Cake of triticale.
6) Cake of wheat with 1% G. M. S.
7) Cake of (75% wheat + 25% triticale) + 1% G. M. S.
8) Cake of (50% wheat + 50% triticale) + 1% G. M. S.
9) Cake of (75% triticale + 25% wheat) + 1% G. M. S.
10) Cake of triticale had 1% G. M. S.
11) Cake of (50% wheat + 50% triticale) blend had 5% dextrin.
12) Cake of (50% triticale + 50% wheat + 1% G. M. S. + 5% dextrin.