4- RESULTS AND DISCUSSION

4.1. Chemical composition or raw materials:

Local wheat flour 72% extraction (Giza 168 variety) and semolina were analyzed for their chemical composition, i.e., moisture, protein, fat, ash and fiber contents. The obtained results are shown in Table (2) and illustrated by Fig (1)

From the results presented in Table (2) and illustrated by Fig (1) it could be noticed that wheat flour of 72% extraction contained 11.58, 0.91, 0.61, 0.51% and 72.79% protein, fat, ash, fiber, and carbohydrate, respectively. While semolina flour contained 14.65, 1.1, 0.69, 1.17, and 70.07% protein, fat, ash, fiber and carbohydrate, respectively.

These results confirmed those obtained by Ally, (2001). The same results were also found to be agreed with those of Mohsen et al., (2000).

4.2. Effect of addition of improving agents on rheological properties of wheat flour:

(monoglyceride in gel form), (Noopazyme enzyme) and (mixture from ascorbic acid with glucose oxidase enzyme) were added to wheat flour of 72% extraction at level of (0, 6, 12 and 18%), (0, 100, 200 and 300ppm) and 0, 300, 600 and 900 ppm), respectively.

The effect of these additives on the farinograph, extrnsograph and amylograph parameters were examined and the obtained results are shown in Tables (3,4 and 5) and illustrated by figures (2 to 10).

Table (2): Chemical composition of wheat flour 72% extraction and semolina .

Chemical Composition / Type of Raw Material	Moisture %	Protein %	Fat %	Ash %	Fiber %	Carbohy-drates* %
Wheat flour 72% extraction	13.60	11.58	0.91	0.61	0.51	72.79
Semolina	12.32	14.65	1.1	0.69	1.17	70.07

* Carbohydrates content was determined by difference.

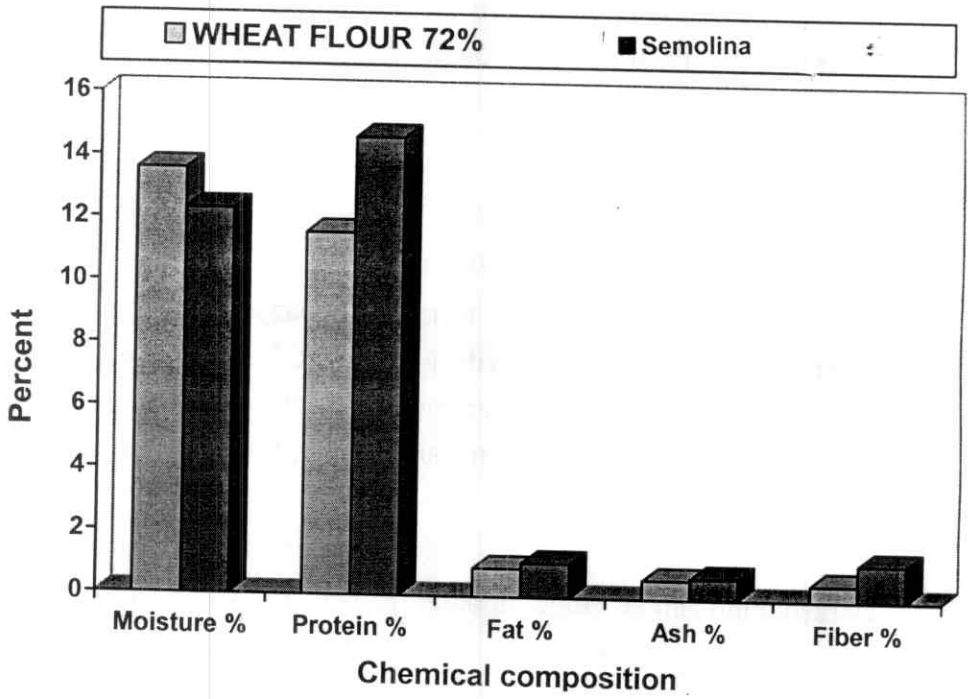


Fig. (1): Chemical composition of wheat flour 72% extraction and semolina .

With respect to farinograph test the results presented in Table (3) and figs. (2 to 4) indicated that addition of monoglyceride in gel form to wheat flour 72% extraction resulted in decreased in arrival time, water absorption, dough development time, dough stability and increased in dough weakening compared to wheat flour 72% extraction without addition (control 1) and semolina (control 2).

These results indicated that addition on monoglyceride to wheat flour doughs decreased dough stability, these results were found to be in agreement with those of **Armera and Coller, (1996).**

The same results presented in Table (4) indicated that addition of Noopazyme enzyme to wheat flour 72% extraction increased the water absorption, arrival time, dough development time, dough stability and decreased dough weakening compared to both flour or semolina control (1 and 2).

These results indicated that addition of Noopazyme enzyme increased dough development time and dough stability. These results also were found to be in agreement with those of **Strachan, (2002)**

Moreover, the results presented in Table (5) indicated that addition of mixture of ascorbic acid with glucose oxidase enzyme to wheat flour (72% extraction) increased the water absorption, dough development time, dough stability while decreased dough weakening.

These results also confirmed those of **Nakamura and Kurata, (1997)** who found that ascorbic acid plays an important role in the rheological properties of dough and as an improver. They found that addition of ascorbic acid to wheat flour 72% extraction doughs increased water absorption and dough stability time may be due to oxygen radical generated during L.ascorbic acid oxidation.

Table (3): Effect of addition of monoglyceride gel to wheat flour of 72%Extraction on Farinograph Parameters

Blends	Water Absorption %	Arrival Time (min.)	Dough Develop-ment time (min.)	Dough Stalitity (min.)	Weak-ening (B.U.)
Control 1*	58.8	1.5	2.0	2.5	100
6%	49.4	1.5	2.0	2.0	120
12%	42.5	1.0	1.5	1.5	150
18%	35.0	1.0	1.5	1.0	160
Control 2**	59.3	1.5	2.5	4.5	80

* **Wheat Flour 72% extraction**

** **Semolina**

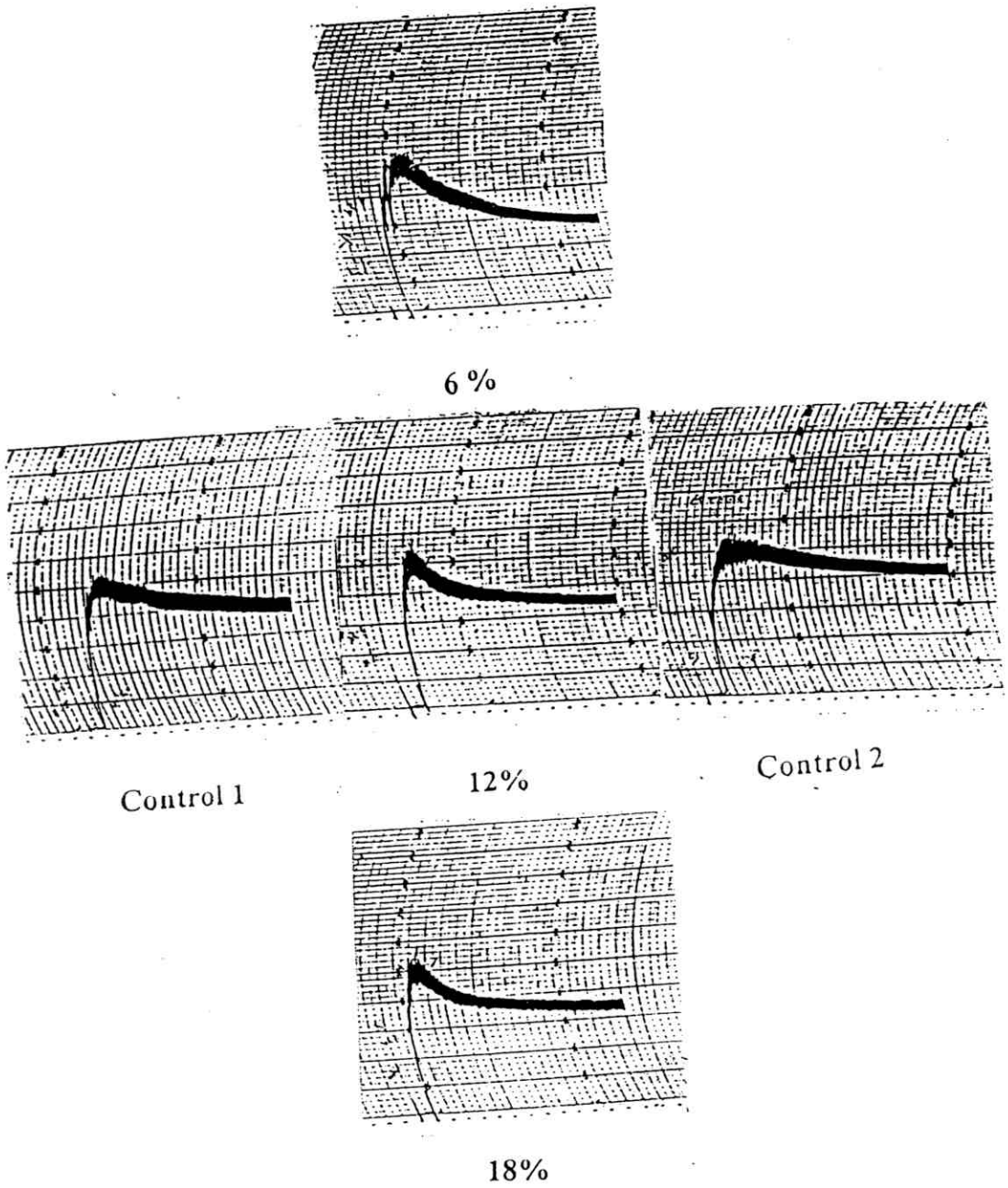


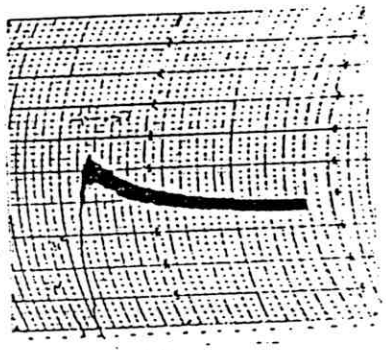
Fig (2): Farinogram of wheat flour 72% extraction (control 1) containing different levels of gel monoglyceride and semolina (control 2).

Table (4): Effect of addition of noopazyme enzyme to wheat flour of 72% Extraction on Farinograph Parameters

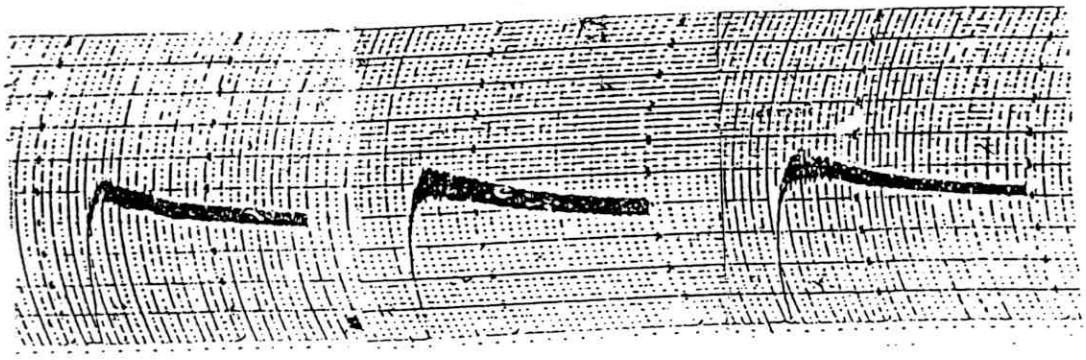
Blends	Water Absorption %	Arrival Time (min.)	Dough Develop-ment time (min.)	Dough Stalitity (min.)	Weak-ening (B.U.)
Control 1*	58.8	1.5	2.0	2.5	100
100 p.p.m.	59.2	1.5	2.0	3.0	90
200 p.p.m.	60.1	2.0	2.5	4.0	80
300 p.p.m.	59.3	1.5	2.0	2.0	105
Control 2**	59.3	1.5	2.5	4.5	80

* Wheat Flour 72% extraction

** Semolina



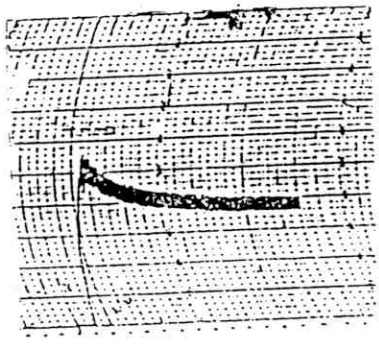
100 p.p.m.



Control 1

200 p.p.m.

Control 2



300 p.p.m.

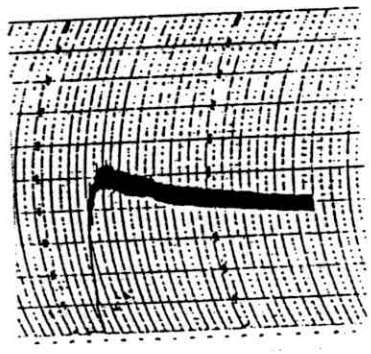
Fig (3): Farinogram of wheat flour 72% extraction (control 1) containing different levels of noopazyme and semolina (control 2).

Table (5): Effect of addition of ascorbic acid with glucose oxidase enzyme to wheat flour of 72% Extraction on Farinograph Parameters

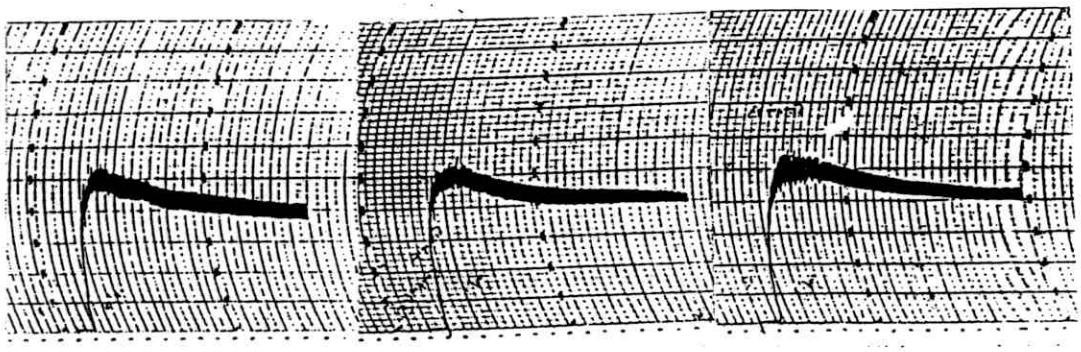
Blends	Water Absorption %	Arrival Time (min.)	Dough Develop-ment time (min.)	Dough Stalitity (min.)	Weak-ening (B.U.)
Control 1*	58.8	1.5	2.0	2.5	100
300 p.p.m.	59.4	1.5	2.5	3.0	90
600 p.p.m.	58.1	1.5	2.5	3.5	85
900 p.p.m.	59.6	1.0	2.0	4.0	80
Control 2**	59.3	1.5	2.5	4.5	80

* **Wheat Flour 72% extraction**

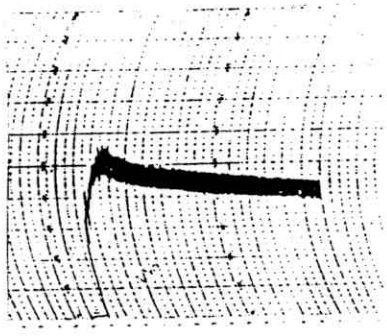
** **Semolina**



300 p.p.m.



Control 1 600 p.p.m. Control 2



900 p.p.m.

Fig (4): Farinogram of wheat flour 72% extraction (control 1) containing different levels of ascorbic acid with glucose oxidase enzyme and semolina (control 2).

These results also confirmed those of **Vemulapalli *et al.*, (1998)** who found that addition of glucose oxidase enzyme to wheat flour decreased the dough weakening but increased water absorption, arrival time and dough stability.

Concerning to extensograph readings, the results presented in Table (6) and illustrated in figs. (5 to 6) revealed that addition of monoglyceride gel to wheat flour 72% extraction lead to increase the extensibility of the dough, while decreased resistance to extension, proportional number and enzyme values compared to control 1 and control 2. But the decreasing rate of these parameters was found to be decreased as level of monoglyceride gel addition was increased.

However, these results were found to be in agreement with those of **Abd El-Lateef and Attia, (1995)** who found that addition of monoglyceride increased dough strength.

The same results in Table (7) illustrated by fig (6) indicated the addition of Noopazyme enzyme to wheat flour (72% extraction) at level of 100, 200 ppm lead to an increase dough extensibility, resistance to extension, proportional number and energy values.

Meanwhile, at level of 300ppm Noopazyme enzyme lead to decrease in the resistance to extension, proportion number and energy values while increased dough extensibility compared to control 1 and control 2.

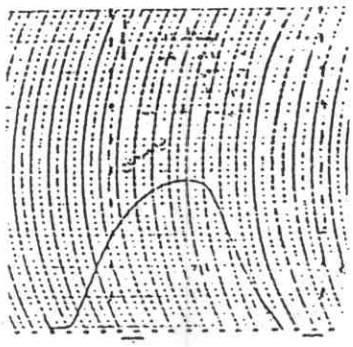
These results confirmed those of **Strachan, (2002)** who reported that addition of Noopazyme enzyme to wheat flour increase the strength of the available gluten in the flour.

Table (6): Effect of addition of monoglyceride gel to wheat flour 72% extraction on extensograph parameters after 135min proofing.

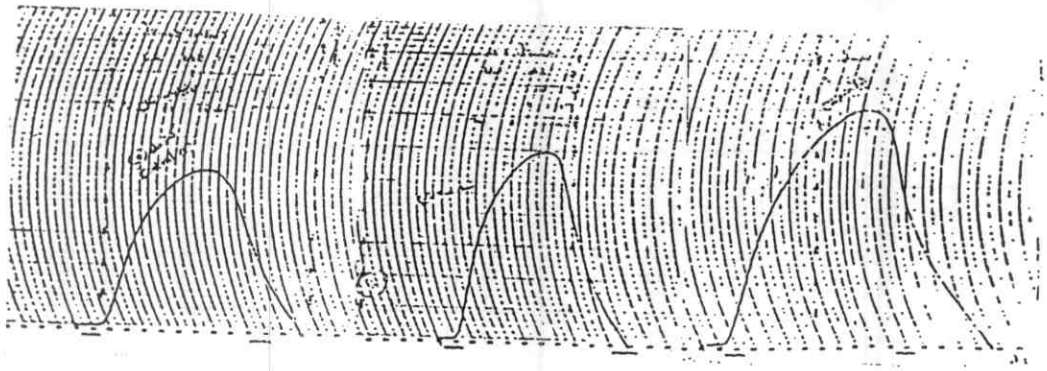
Blends	Extensibility m.m	Resistance to Extension B.U	Proportional Number (P.N)	Energy Cm^2
Control 1*	115	500	4.35	90.0
6%	120	480	4.00	88.5
12%	125	460	3.83	87.0
18%	130	440	3.38	85.5
Control 2**	120	740	5.90	135.0

* **Wheat Flour 72% extraction**

** **Semolina**



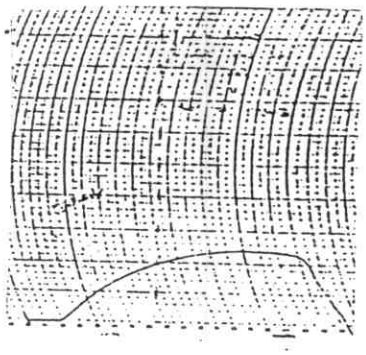
6 %



Control 1

12%

Control 2



18%

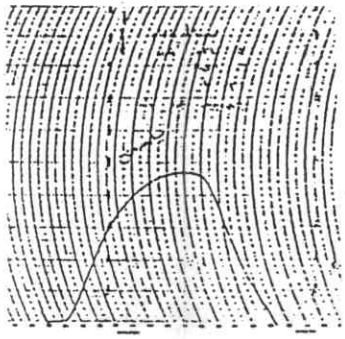
Fig (5): Extensograms of wheat flour 72% extraction (control 1) containing different levels of gel monoglyceride and semolina (control 2).

Table (7): Effect of addition of noopazyme enzyme to wheat flour 72% extraction on extensograph parameters after 135 min proofing

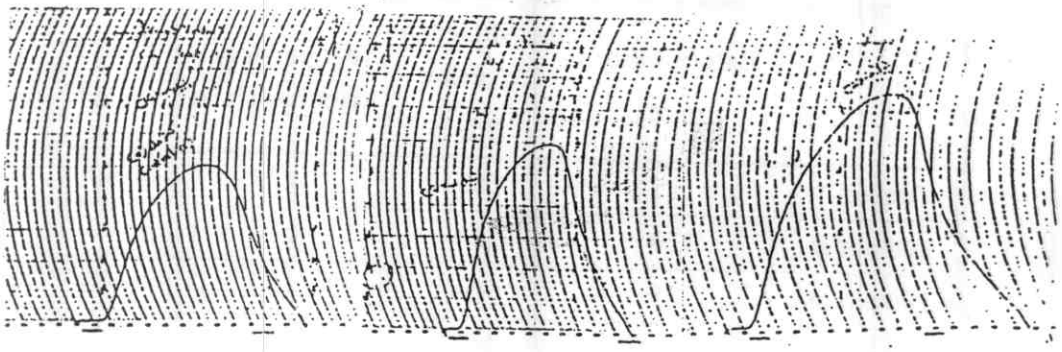
Blends	Extensibility m.m	Resistance to Extension B.U	Proportional Number (P.N)	Energy Cm^2
Control 1*	115	500	4.35	90
100 p.p.m.	120	520	4.00	90
200 p.p.m.	125	600	4.80	97
300 p.p.m.	165	440	1.40	41
Control 2**	120	740	5.90	135

* **Wheat Flour 72% extraction**

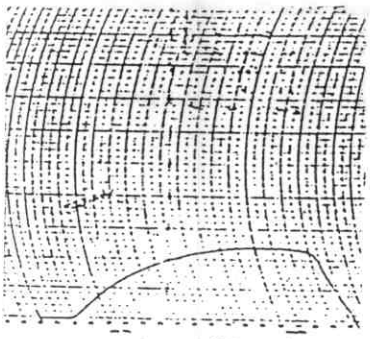
** **Semolina**



100 p.p.m.



Control 1 200 p.p.m. Control 2



300 p.p.m.

Fig (6): Extensograms of wheat flour 72% Extraction (control 1) Containing different levels of noopazyme enzyme and semolina (control 2)

Moreover, the same results indicated also that addition of mixture of ascorbic acid with glucose oxidase enzyme to wheat flour (72% extraction) resulted in an increase in the resistance to extension, proportional number and energy values while decreased dough extensibility in comparison to control 1 and control 2.

These results were found to be in agreement with those of **Nakamura and Kurata, (1997).** They reported that addition of ascorbic acid to wheat flour doughs improved the rheological properties of dough and its three dimensional network are dependent on the interaction of sulfhydryl group (SH) and Disulfide (SS) bonds of protein molecules.

The results also confirmed those of **Vemulapalli and Hoseney, (1998)** who reported that addition of glucose oxidase enzyme to wheat flour improved the rheological properties. They also found that addition of glucose oxidase enzyme to wheat flour increased dough strength.

On the other hand, amylograph test was also carried out to examine the effect of the previous improving on viscosity properties of wheat flour (72% extraction). The results presented in Table (9) and illustrated in figs (8 to 10) showed that addition monoglyceride in gel form to wheat flour resulted in an increase in the maximum viscosity and the increase was found to be parallel with the increase of addition level. The results indicated also that temperature of transition and temperature of maximum viscosity increased due to monoglyceride in gel form addition. Compared to wheat flour 72% extraction whithout addition (control 1) and semolina (control 2).

Table (8): Effect of addition of ascorbic acid with glucose oxidase enzyme to wheat flour of 72% extraction on extensograph parameters after 135 min proofing

Blends	Extensibility m.m	Resistance to Extension B.U	Proportional Number (P.N)	Energy Cm^2
Control 1*	115	500	4.35	90
300 p.p.m.	110	590	5.40	93
600 p.p.m.	100	610	6.10	100
900 p.p.m.	90	730	8.10	165
Control 2**	120	740	5.90	135

* **Wheat Flour of 72% extraction**

** **Semolina**

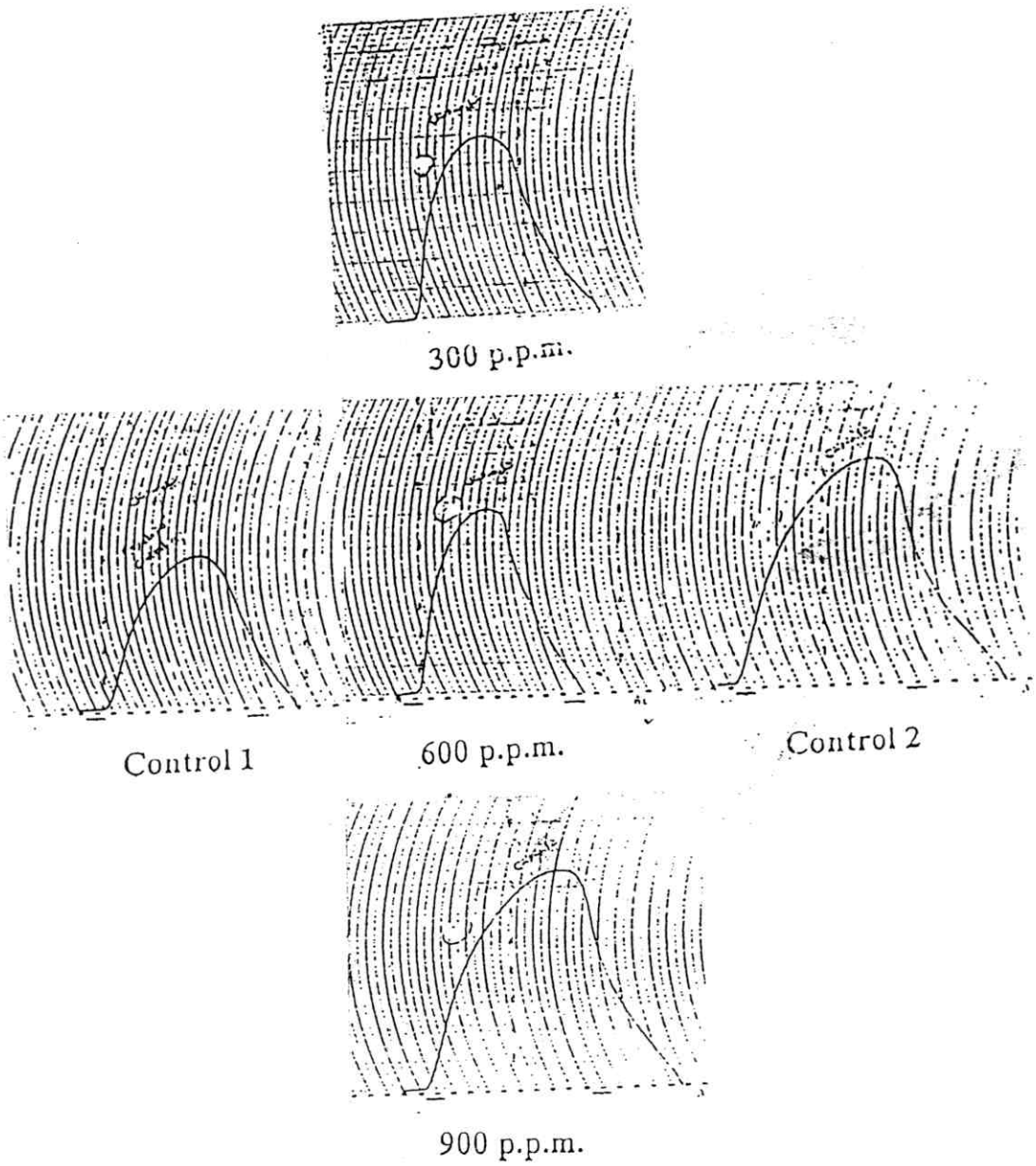


Fig (7): Extensogram of wheat flour 72% extraction (control 1) containing different levels of ascorbic acid with glucose enzyme and semolina (control 2).

Table (9) : Effect of addition of monogloceride gel to wheat flour of 72% extraction on amylograph parameters

Blends	Temp. of transition C	Maximum viscosity B.U	Temp. of Max viscosity C
Control*	45.0	580.0	61.5
6%	60.0	835.0	89.0
12%	61.0	870.0	89.0
18%	62.0	920.0	89.0
Control**	55.5	735.0	89.0

*** Wheat flour of 72% extraction**

**** Semolina**

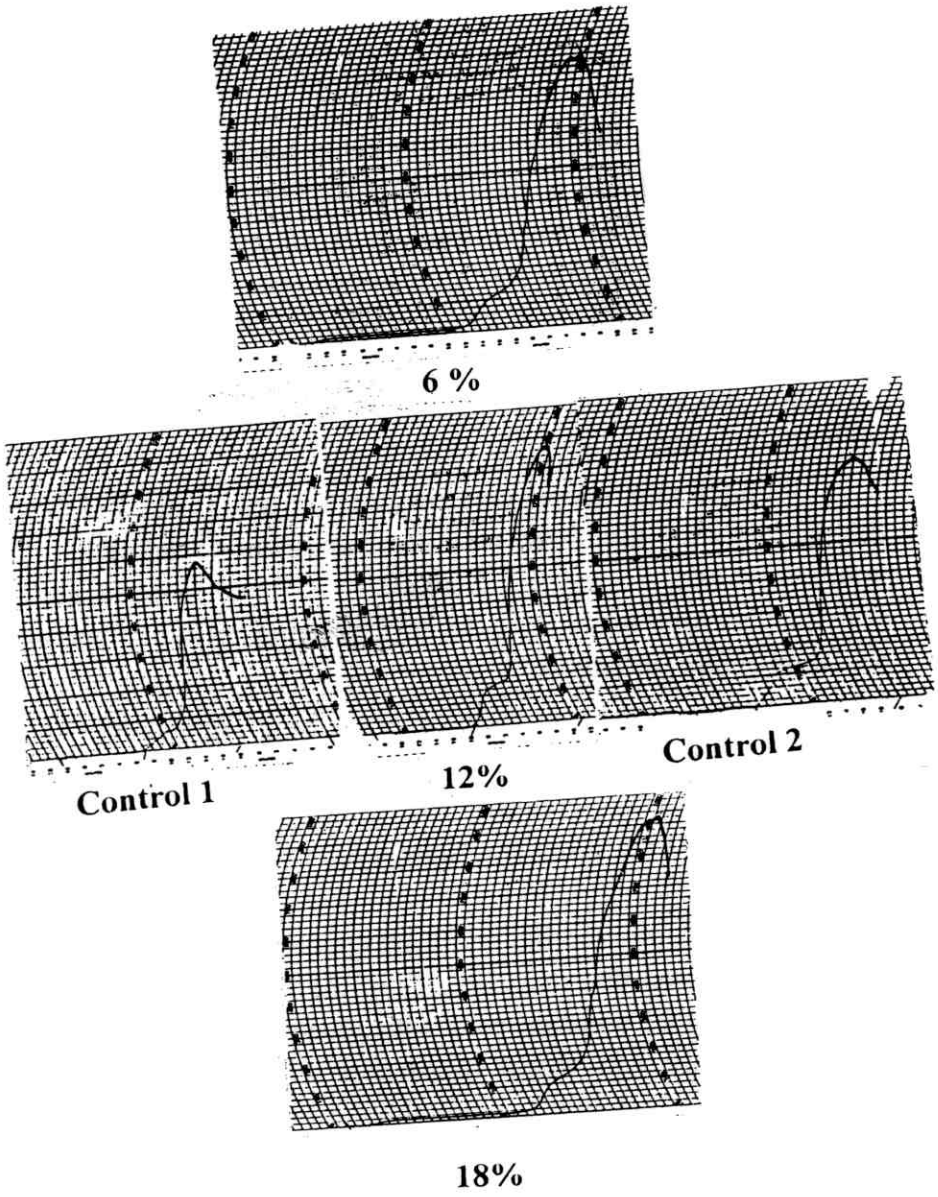


Fig (8): Amylograms of wheat flour 72% extraction (control 1) containing different levels of gel monoglyceride and semolina (control 2).

These results were found to be in agreement with those of **Abd El-Lateef and Attia, (1995),** who found that using 0.5% monoglyceride white wheat flour 72% extraction lead to an increase in temperature of transition and temperature of maximum viscosity. They also suggested that using of 0.5% monoglyceride improved dough handling properties and increased the tolerance for high absorption in comparison on with control sample.

Concerning noopazyme enzyme, the results showed that the viscosity of the flour was decreased due to addition of noopazyme enzyme and the decreased was found to be parallel with the increase of addition level. Compared to both flour or semolina control (1 and 2).

These results also were found to be in agreement with those of **Strachan, (2002)** who reported that addition of noopazyme enzyme increases the number of amylose-lipid complexes and these complexes inhibit the excessive swelling of starch granules.

Concerning ascorbic acid with glucose oxidase enzyme, the results showed that the viscosity of the flour was increased due to addition of ascorbic acid with glucose oxidase enzyme and the increase was found to parallel with the increase of addition level. Compared to both flour or semolina control (1 and 2).

These results also confirmed those of **Nokamura and Kurata, (1997)** who reported the ascorbic acid has been suggested that rheological properties of dough were improved in the presence of reducing substances, such as ascorbic acid, that directly or indirectly affected the structure and intermolecular interaction of protein molecules in dough.

Table (10) : Effect of addition of noopazyme enzyme to wheat flour of 72% extraction on amylograph parameters

Blends	Temp. of transition C	Maximum viscosity B.U	Temp. of Max viscosity C
Control*	45.0	580	61.5
100 p.p.m.	65.0	500	89.0
200 p.p.m.	67.0	395	89.0
300 p.p.m.	72.0	365	88.5
Control**	55.5	735	89.0

*** Wheat flour of 72% extraction**

**** Semolina**

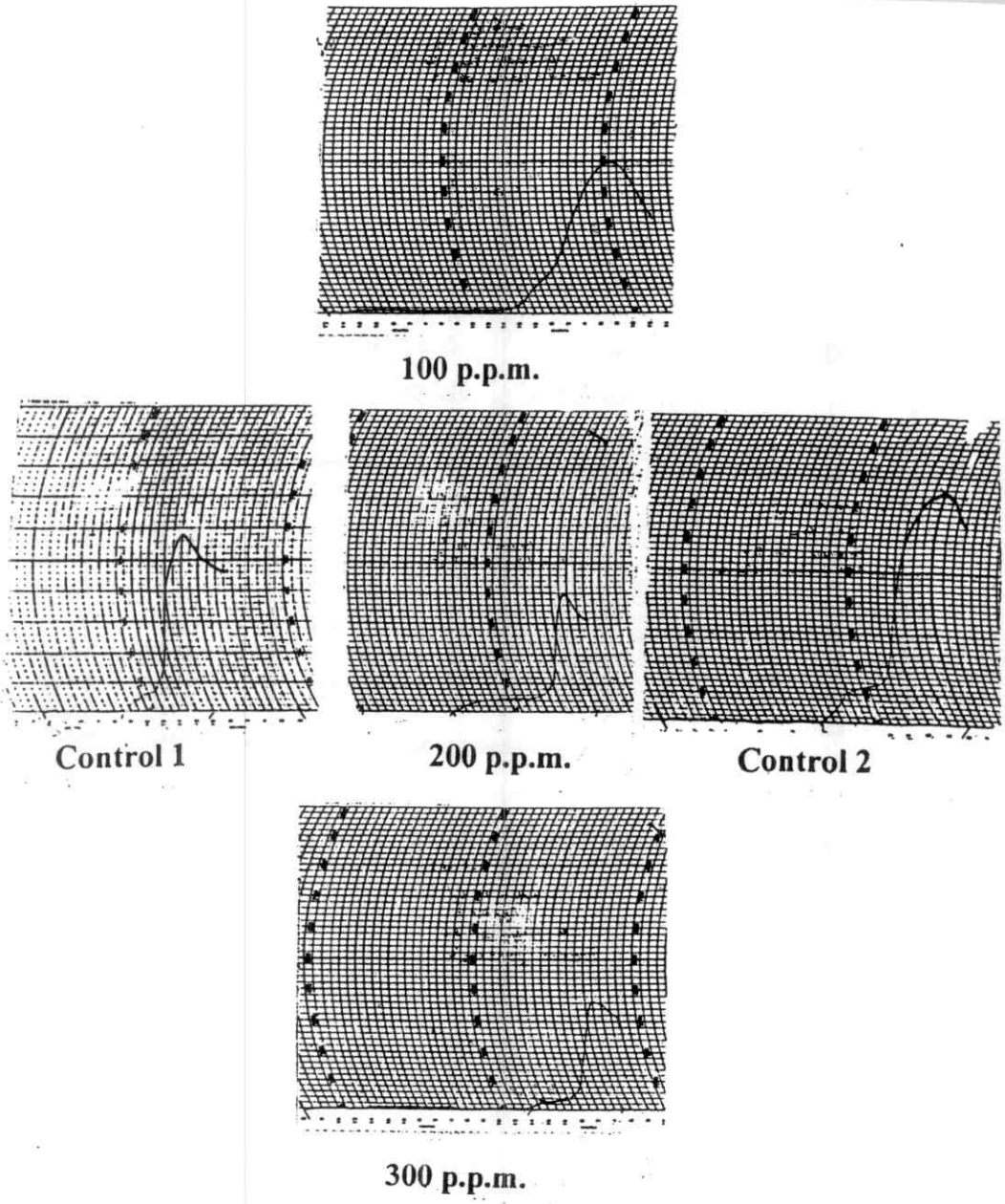


Fig (9): Amylograms of wheat flour 72% extraction (control 1) containing different levels of noopazyme enzyme and semolina (control 2).

Table (11) : Effect of addition of ascorbic acid with glucose oxidase enzyme to wheat flour of 72% extraction on amylograph parameters

Blends	Temp. of transition C	Maximum viscosity B.U	Temp. of Max viscosity C
Control*	45.0	580	61.5
300 p.p.m.	60.0	750	89.0
600 p.p.m.	63.0	775	89.0
900 p.p.m.	64.0	810	90.0
Control**	55.5	735	89.0

*** Wheat flour of 72% extraction**

**** Semolina**

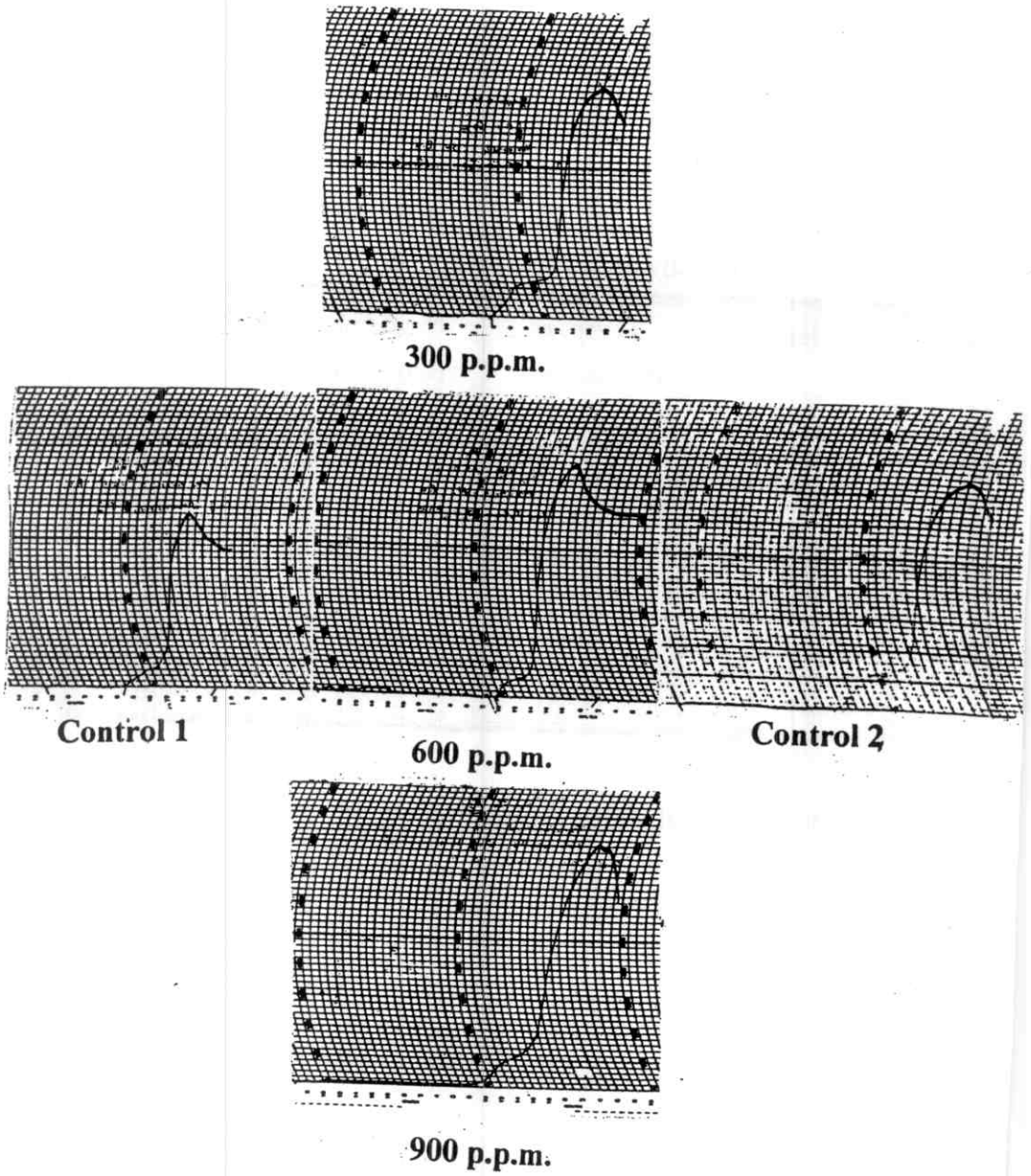


Fig (10): Amylograms of wheat flour 72% extraction (control 1) containing different levels of ascorbic acid with glucose enzyme and semolina (control 2).

These results also confirmed those of **Vemulapalli *et al.*, (1998)** who found that addition of glucose oxidase enzyme to wheat flour increased in viscosity of water-soluble fraction isolated from flour. The H_2O_2 generated by glucose oxidase enzyme in the presence of peroxidase may have been responsible for the increase in viscosity.

4.3. Effect of addition of improving agents on cooking quality of spaghetti:

4.3.1. Effect of monoglyceride gel on cooking quality of spaghetti:

Cooking properties of the produced spaghetti are presented in Table (12) properties included percentage of volume increasing, percentage of weight increasing and total soluble solids percentage in cooking water (cooking loss).

From these results it could be noticed the cooking quality of spaghetti produced from wheat flour 72% extraction.

Increased percentage of both weight, volume of the produced spaghetti and decreased cooking loss by added 12% of monoglyceride than spaghetti made from wheat flour 72% extraction and other blends or control made from wheat flour (control 1), but spaghetti made from semolina decreased cooking loss than spaghetti made from wheat flour 72% extraction and other blends.

In the tabulated results indicated that addition of monoglyceride in gel form at levels of 6%, 12% and 18% to produced spaghetti which had the highest volume increase 175% at level 6% addition, 275 at level 12% addition and 185% at level 18% addition, respectively.

Table (12): Cooking quality properties for spaghetti containing different levels of monoglyceride gel

Blends	Percentage of volume increase	Percentage of weight increase	Cooking loss %
Wheat flour 72% extraction	150	151	9.66
6%	175	243	9.2
12%	275	286	6.4
18%	185	200	7.8
Semolina	193.7	180	5.98

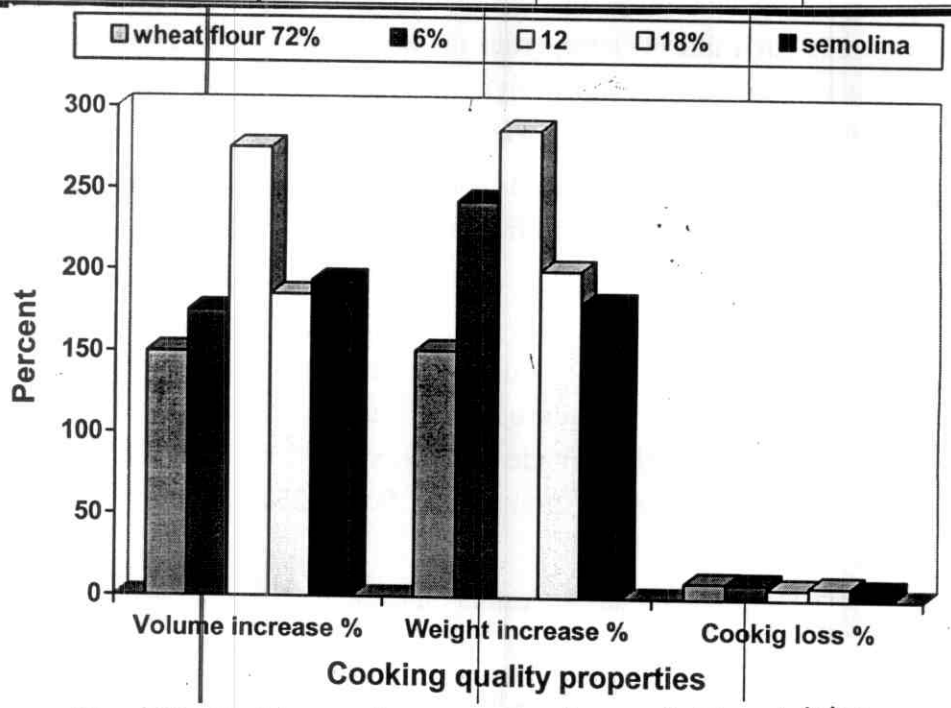


Fig. (11): Cooking quality properties for spaghetti containing different levels of monoglyceride gel

While spaghetti made from wheat flour 72% extraction without addition (control 1) had the highest volume increase 150% and spaghetti made from semolina (control 2) had the highest volume increase 193.7% respectively besides the highest weight increase were 243, 286 and 200%, respectively. While, control (1) had the highest weight increase 151% and control (2) had the highest weight increase 180%, results also indicated that the total soluble solids content were 9.2, 6.4 and 7.8%, respectively, while control (1) the total soluble solids content 9.66% and control (2) total soluble solids content 5.98%, respectively.

These results were found to be in agreement with those of **Abdel Lateef and Attia, (1995)** who found that using 1% monoglyceride produced a good cooking quality of macaroni.

These results were found to be in agreement with those of **Matsuo *et al.*, (1986)** who found that using monoglyceride produced decreased in cooking loss of spaghetti than spaghetti made from wheat flour without addition.

4.3.2. Effect of Noopazyme enzyme on cooking quality of spaghetti:

Cooking properties of the produced spaghetti are presented in Table (13).

From these results it could be noticed that cooking quality of spaghetti produced from wheat flour 72% extraction increased percentage of both weight, volume of the produced spaghetti and decreased cooking loss by added 200 ppm of Noopazyme enzyme than control (1) (spaghetti made from wheat flour 72% extraction without addition) and other blends.

Table (13): Cooking quality properties for spaghetti containing different levels of noopazyme enzyme.

Blends	Percentage of volume increase	Percentage of weight increase	Cooking loss %
Wheat flour 72% extraction	150	151	9.66
100 p.p.m	175	155	9.3
200 p.p.m	180	159	7.2
300 p.p.m	175	156	9.2
Semolina	193.7	180	5.98

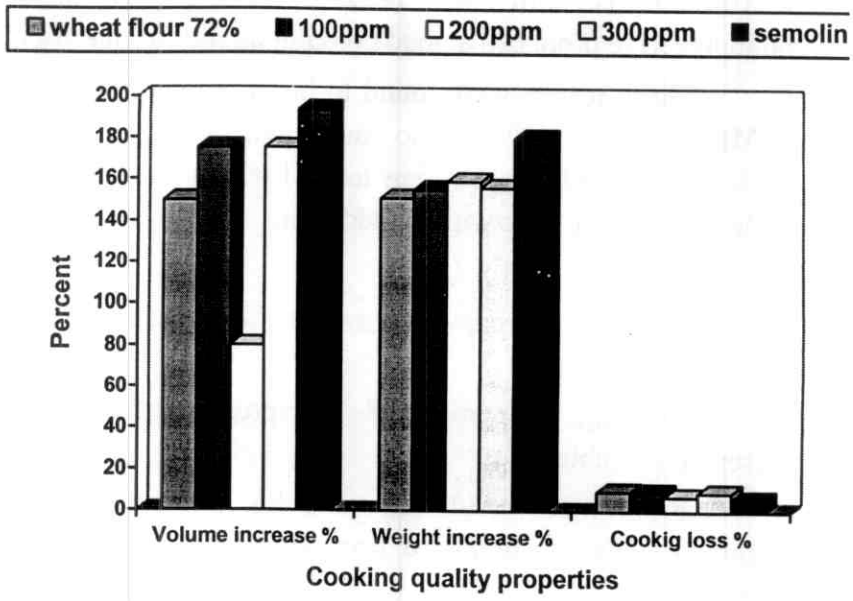


Fig. (12): Cooking quality properties for spaghetti containing different levels of noopazyme enzyme.

While, the more increased percentage of weight and volume of the produced spaghetti and more decreased cooking loss by spaghetti made from semolina than control 1 and other blends.

In the connection tabulated results indicated that addition of Noopazyme enzyme at level 100ppm, 200ppm and 300ppm to produced spaghetti made from wheat flour 72% extraction had the highest volume increase 175% at level 100ppm addition, 180 at level 200ppm and 175% at level 300ppm addition, respectively.

Spaghetti made from wheat flour 72% extraction without addition (control 1) showed that volume increase by 150% and spaghetti made from semolina (control 2) indicated that volume increase 193.7%, the same table (13) indicated that The highest weigh increase were 155, 159 and 156%, respectively. While control (1) had the highest weight increase 151% and control (2) had the highest weigh increase 180%, on the other hand the total soluble solids content were 9.3, 7.2, 9.2% respectively, while control (1) the total soluble solids content 9.66% and control (2) the total soluble solids content 5.98% . These results were found to be in agreement with those of **Strachan, (2002)** who reported that the lipase modifies the native lipids in the flour, enabling the formation of lipid-amylase complex, which, in turn, inhibit the swelling and leaching of amylose during cooking. He also found that Noopazyme enzyme has introduced a microbial lipase, Noopazyme improves the overall quality flour oriental noodles made from low quality flour and pasta made from non-durum flour.

4.3.3. Effect of mixture from ascorbic acid and glucose oxidase enzyme on cooking quality of spaghetti:

Cooking properties of the produced spaghetti was presented in Table (14).

From these results it could be noticed that cooking quality of spaghetti produced from wheat flour 72% extraction increased percentage of both weight, volume and decreased cooking loss by added 900ppm of mix ascorbic acid and glucose oxidase enzyme than control (1) and other blends, While, the more increased percentage of weight and volume of the produced spaghetti and more decreased cooking loss by spaghetti made from semolina than control (1) and other blends.

In the connection tabulated results indicated that addition of mix ascorbic acid and glucose oxidase enzyme at level 300ppm, 600ppm and 900ppm to spaghetti made from wheat flour 72% extraction had the highest volume increase of 185,188 and 189 respectively.

While, spaghetti made from wheat flour 72% extraction without addition (control 1) had the highest volume increase 150% and spaghetti made from semolina (control 2) had the highest volume increase 193.7%, respectively.

Table (14): Cooking quality properties for spaghetti containing different levels of ascorbic acid and glucose oxidase enzyme

Blends	Percentage of volume increase	Percentage of weight increase	Cooking loss %
Wheat flour 72% extraction	150	151	9.66
300 p.p.m	185	154.5	8.9
600 p.p.m	188	156	7.8
900 p.p.m	189	158	7.0
Semolina	193.7	180	5.98

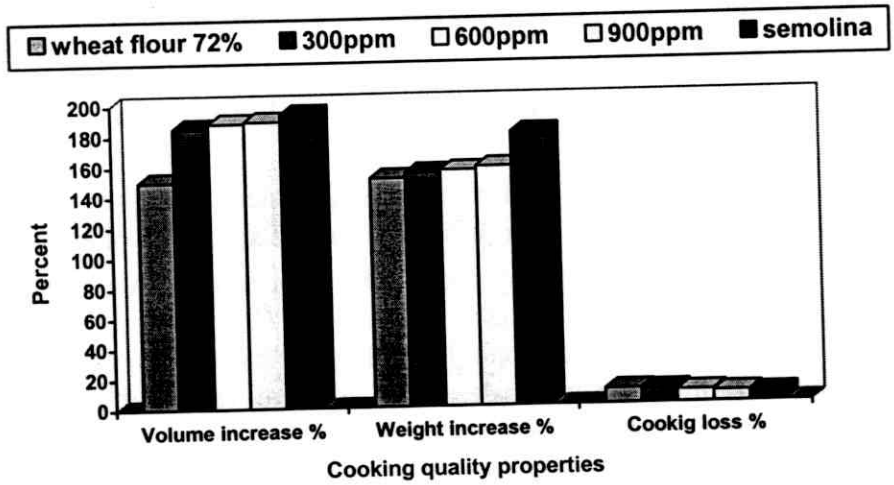


Fig. (13): Cooking quality properties for spaghetti containing different levels of ascorbic acid and glucose oxidase enzyme

Besides, results given in table (14) indicated that The highest weight increase were 154.5, 156 and 158%, respectively. While control (1) had the highest weight increase 151% and control (2) had the highest weight increase 180%, also cooking loss were 8.9, 7.8, 7 %, respectively. While, control (1) the total soluble solids content 9.66% and control (2) the total soluble solids content 5.98% .

These results were found to be in agreement with those of **Kim *et al.*, (1989)** who found that adding 300ppm L-ascorbic acid increased yellow pigment and improved in cooking quality of spaghetti made from wheat flour 72% extraction, these results also confirmed those obtained by **Vemulapalli *et al.*, (1998)** who found that the level of glucose oxidase necessary to obtain the optimum strengthening apparently resulted in doughs that appeared to be overoxidized.

4.4. Effect of addition of improving agents on Iodine blue value of spaghetti:

4.4.1. Effect of monoglyceride gel on Iodine blue value of spaghetti:

Iodine Blue value of the produced spaghetti were presented in Table (15) as indication for the solubility of starch.

From these results it could be noticed that blue value of spaghetti produced from wheat flour 72% extraction high decreased by 12% of monoglyceride gel than control (1), other blends, while, the more decreased of blue value by spaghetti made from semolina was indicated .

In the connection tabulated results indicated that addition of monoglyceride gel at level 6%, 12% and 18% to spaghetti which made from wheat flour 72% extraction had blue value 0.3369 at level 6% addition, 0.3142 at level 12% and 0.3358 at level 18% addition, respectively.

Table (15): Iodine Blue value of spaghetti containing different levels of monoglyceride gel

Blends	**Iodine Blue Value**
Wheat flour of 72% extraction	0.4847
6%	0.3369
12%	0.3142
18%	0.3358
Semolina	0.3009

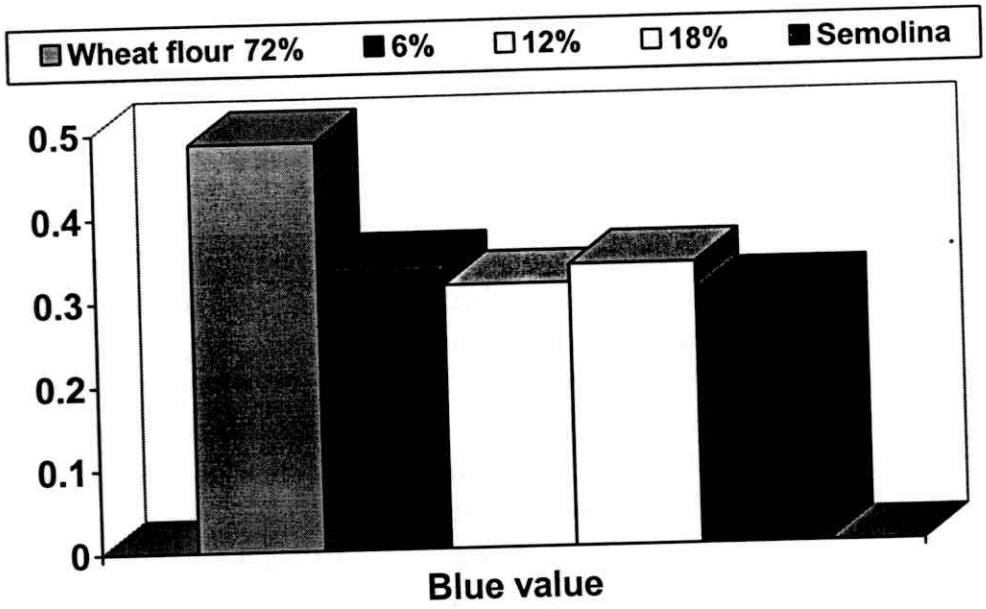


Fig. (14): Iodine Blue value of spaghetti containing different levels of monoglyceride gel

While, spaghetti made from wheat flour 72% extraction without addition (control 1) had blue value 0.4847 and spaghetti made from semolina (control 2) had blue value 0.3009.

These results was found to be in agreement with those of **Kim *et al.*, (1989)** who found that monoglyceride reduced the iodine blue value (absorbance at 660nm) of the material that dissolved in water when the cooked and cooled spaghetti was rinsed.

4.4.2. Effect of Noopazyme enzyme on Iodine blue value of spaghetti:

Blue value of the produced spaghetti were presented in Table (16) as indication for the solubility of starch. From these results it could be noticed that blue value of spaghetti produced from wheat flour 72% extraction showed high decreased by 200ppm of Noopazyme enzyme than control (1) and other blends. While, the more decreased of blue value by spaghetti made from semolina than control (2) and other blends was observed .

In the connection tabulated results indicated that addition of Noopazyme enzyme at level 100ppm, 200ppm and 300 ppm to produced spaghetti made from wheat flour 72% extraction had blue value 0.4690 at level 100ppm addition, 0.3740 at level 200ppm and 0.4635 at level 300ppm . While, spaghetti made from wheat flour 72% extraction without addition (control 1) had Iodine blue value of 0.4847 and spaghetti made from semolina (control 2) 0.3009.

These results confirmed those of **Strachan, (2002)** who found that new Noopazyme is a lipase that improves the overall quality of noodles or wheat-based pasta products as reduces the stickiness of overcooked noodles and pasta.

Table (16): Iodine Blue value of spaghetti containing different levels of noopazyme enzyme.

Blends	Iodine Blue Value
Wheat flour of 72% extraction	0.4847
100 p.p.m	0.4690
200 p.p.m	0.3740
300 p.p.m	0.4635
Semolina	0.3009

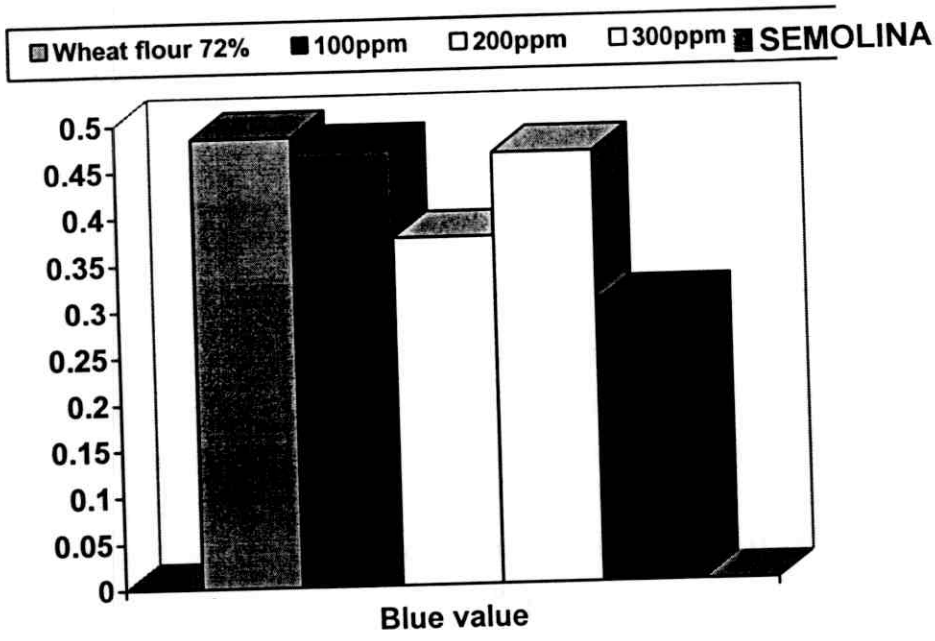


Fig. (15): Iodine Blue value of spaghetti containing different levels of noopazyme enzyme.

4.4.3. Effect of mixture of ascorbic acid and glucose oxidase enzyme on Iodine blue value of spaghetti:

Iodine blue value of the produced spaghetti were presented in Table (17) as indication for the solubility of starch. From these results it could be noticed that blue value of spaghetti produced from wheat flour 72% extraction high decreased by 900ppm of ascorbic acid and glucose oxidase enzyme than control (1) and other blends, while the more decreased of blue value by spaghetti made from semolina than control (2) and other blends was found.

In the connection tabulated results indicated that addition of ascorbic acid and glucose oxidase enzyme at level 300ppm, 600ppm and 900ppm to spaghetti made from wheat flour of 72% extraction had blue value 0.4478, 0.3982 and 0.3838 .

While, spaghetti made from wheat flour 72% extraction without addition (control 1) had blue value 0.4847 and spaghetti made from semolina (control 2) had blue value 0.3009, respectively.

These results confirmed those of **Kim *et al.*, (1989)** who reported that adding 300 ppm L-ascorbic acid reduced stickiness of spaghetti made from wheat flour 72% extraction. These results also confirmed those of **Vemulapalli and Hoseney, (1998)** who found that glucose oxidase caused oxidative gelation of the water soluble fraction extracted from flour.

Table (17): Iodine blue value of spaghetti containing different levels of ascorbic acid and glucose oxidase enzyme.

Blends	Iodine Blue Value
Wheat flour of 72% extraction	0.4847
300 p.p.m	0.4478
600 p.p.m	0.3982
900 p.p.m	0.3838
Semolina	0.3009

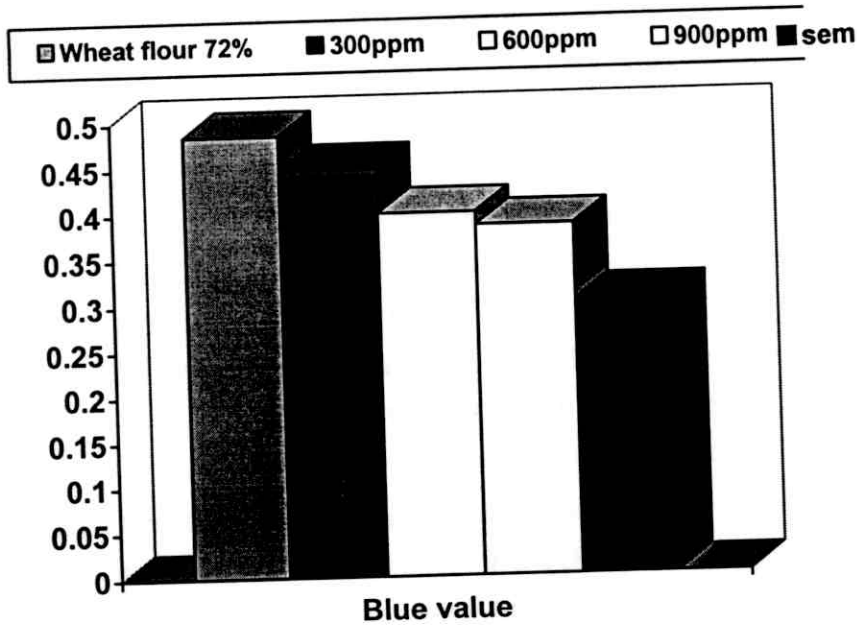


Fig. (16): Iodine blue value of spaghetti containing different levels of ascorbic acid and glucose oxidase enzyme

4.5. Effect of addition of improving agents on mean values firmness of spaghetti:

4.5.1. Effect of monoglyceride gel on mean values firmness of spaghetti:

Mean values firmness of the produced spaghetti were presented in Table (18).

From these results it could be noticed that mean values firmness of spaghetti produced from wheat flour 72% extraction showed high level of firmness by 12% of monoglyceride gel than control (1) and other blends. While, the more increased of value firmness indicated by spaghetti made from semolina than control (2) and other blends.

In the connection tabulated results indicated that addition of monoglyceride gel at level 6%, 12% and 18% to spaghetti made from wheat flour 72% extraction had mean values firmness 0.06 Lb/In^2, 0.12 Lb/In^2 and 0.09 Lb/In^2. While, spaghetti made from wheat flour 72% extraction without addition (control 1) had mean values firmness 0.04 Lb/In^2 and spaghetti made from semolina (control 2) had mean values firmness 0.18 Lb/In^2, respectively.

These results was found to be in agreement with those of **Kim *et al.*, (1989)** who found that monoglyceride softened the texture of the cooked pasta, monoglyceride also reduced the cutting strength of cooked farina spaghetti and monoglyceride reduction of surface stickiness which may be related to the complexing of amylase with monoglyceride.

Table (18): Mean values of firmness (shear force) for cooking spaghetti containing different levels of monoglyceride gel

Blends	**Firmness (shear force) LB/In^2**
Wheat flour of 72% extraction	0.04
6%	0.06
12%	0.12
18%	0.09
Semolina	0.18

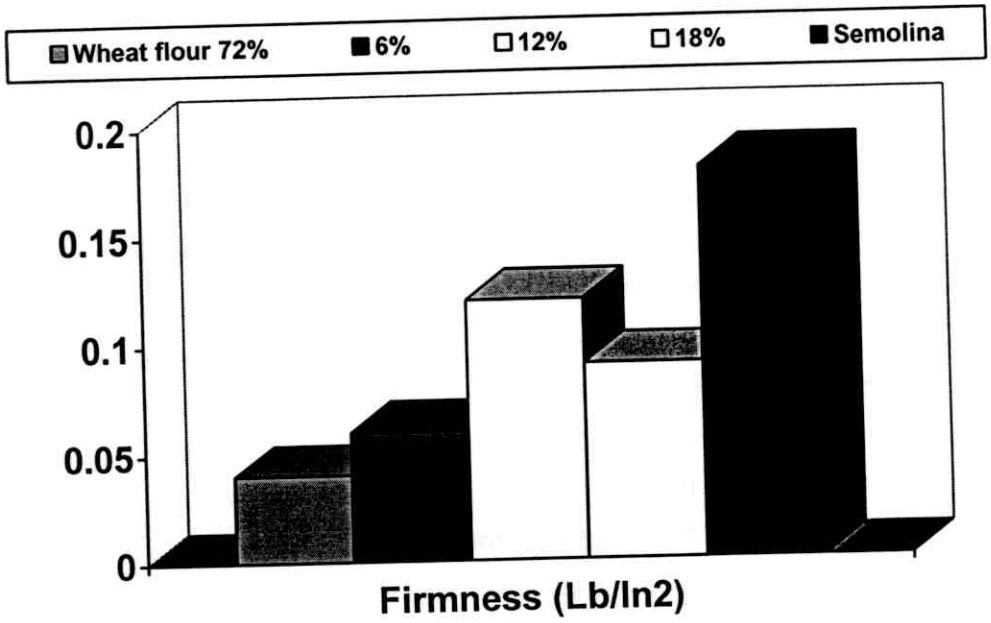


Fig. (17): Mean values of firmness (shear force) for cooking spaghetti containing different levels of monoglyceride gel

4.5.2. Effect of Noopazyme enzyme on mean values of spaghetti firmness:

Firmness Mean values of the produced spaghetti was presented in Table (19).

From these results it could be noticed that firmness mean values of spaghetti produced from wheat flour 72% extraction high value of firmness by 200ppm of Noopazyme enzyme than control (1) and other blends. While, the more increased of value firmness by spaghetti made from semolina than control (2) and other blends.

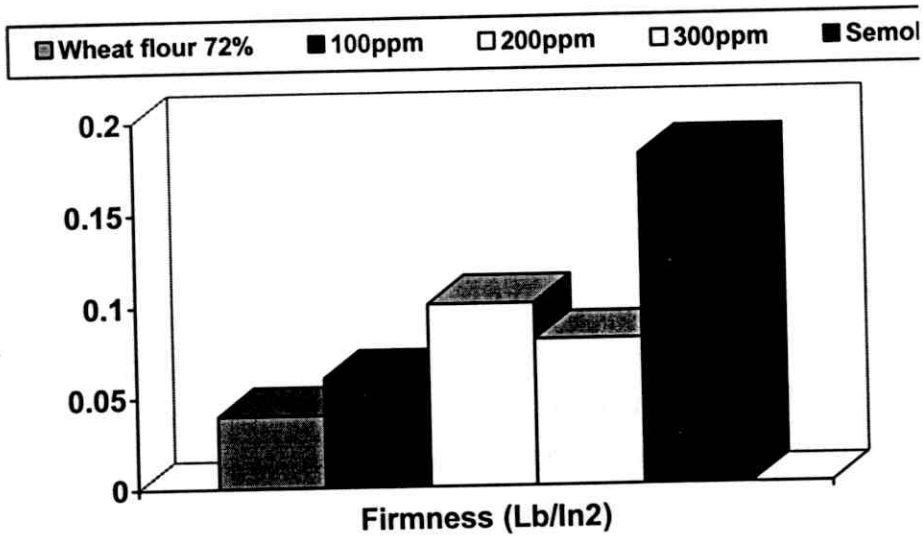
In the connection tabulated results indicated that addition of Noopazyme enzyme at level 100ppm, 200ppm and 300ppm to produced spaghetti which made from wheat flour 72% extraction had mean values firmness 0.06 Lb/In^2, 0.10 Lb/In^2 and 0.08 Lb/In^2 .

While, spaghetti made from wheat flour 72% extraction without addition 9control 1) had mean values firmness 0.04 Lb/In^2 and spaghetti made from semolina (control 2) 0.18 Lb/In^2.

These results was found to be in agreement with those of **Strachen, (2002)** who reported that Noopazyme enzyme can be improve the quality of noodles and pasta made from poor quality raw protein flour by increasing the strength of the available gluten in the flour. He also found that Noopazyme increased the firmness of noodles and pasta based on wheat flour.

Table (19): Firmness Mean values (shear force) of cooked spaghetti containing different levels of noopazyme enzyme

Blends	**Firmness (shear force) LB/In^2**
Wheat flour 72% extraction	0.04
100 p.p.m	0.06
200 p.p.m	0.10
300 p.p.m	0.08
Semolina	0.18



ig. (18): Firmness mean values (shear force) of cooked spaghetti containing different levels of noopazyme enzyme

4.5.3. Effect of ascorbic acid and glucose oxidase enzyme on firmness mean values of spaghetti:

Mean values firmness of the produced spaghetti was presented in Table (20).

From these results it could be noticed that mean values firmness of spaghetti produced from wheat flour 72% extraction had high value of firmness by 900ppm of ascorbic acid and glucose oxidase enzyme than control (1) an other blends. While, the more increased of mean values firmness by spaghetti made from semolina was observed than control (2) an other blends.

In the connection tabulated results indicated that addition of ascorbic acid and glucose oxidase enzyme at level 300ppm, 600ppm and 900ppm to produced spaghetti made from wheat flour 72% extraction had mean values firmness 0.05 Lb/In^2, 0.09 Lb/In^2 and 0.12 Lb/In^2. While, spaghetti made from wheat flour 72% extraction without addition (control 1) had mean values firmness 0.04 Lb/In^2 and spaghetti made from semolina (control 2) had mean values firmness and 0.18 Lb/In^2, respectively.

These results to be in agreement with those of **Kim *et al.*, (1989)** who found that a firm spaghetti with non sticky produced by addition 300ppm of ascorbic acid.

These results also found to be in agreement with those of **Vemulopalli *et al.*, (1998)** who reported that the doughs made containing glucose oxidase felt dry and had strong handling properties. They also found that the H_2O_2 produced by glucose oxidase may have been responsible for the strong and dry doughs.

Table (20): Firmness mean values firmness (shear force)of cooked spaghetti containing different levels of ascorbic acid and glucose oxidase enzyme

Blends	Firmness (shear force) LB/In^2
Wheat flour 72% extraction	0.04
300 p.p.m	0.05
600 p.p.m	0.09
900 p.p.m	0.12
Semolina	0.18

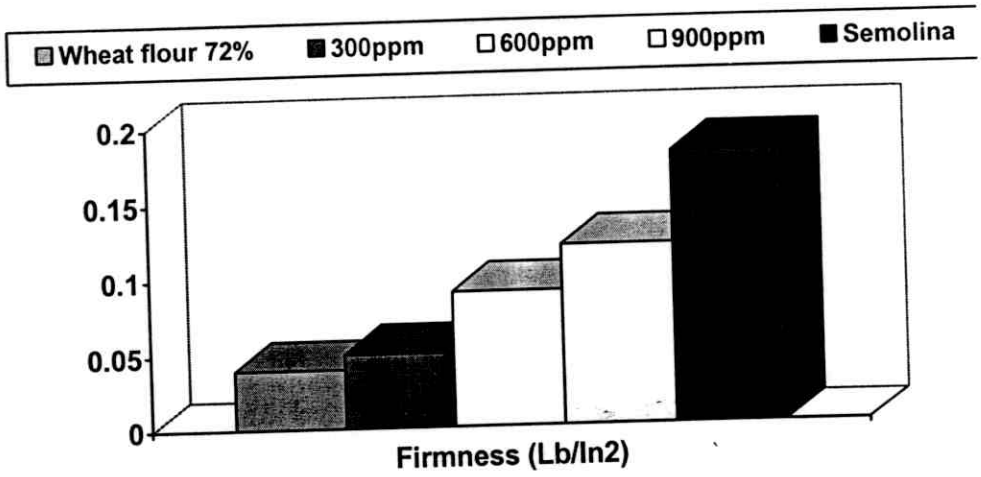


Fig. (19): Firmness Mean values (shear force)of cooked spaghetti containing different levels of ascorbic acid and glucose oxidase enzyme

4.6. Effect of improving agents on sensory evaluation of spaghetti:

Spaghetti samples that produced from semolina and wheat flour 72% extraction (with or without addition of monoglyceride gel, Noopazyme enzyme and ascorbic acid with glucose oxidase) were evaluated for their sensory characteristics, i.e., appearance, color, flavor, tenderness, stickiness and overall acceptability. The obtained data were also statistically analyzed and obtained results are shown in Tables (21 to 23).

4.6.1. Effect of monoglyceride gel :

The results presented in Table (21) showed the effect of addition of gel monoglyceride to wheat flour (72% extraction) at levels of 0, 6%, 12% and 18% on sensory characteristics of spaghetti made from wheat flour 72% extraction compared with spaghetti made from semolina.

From these results it could be noticed that control 2 samples (spaghetti made from semolina) found to have excellent quality grade (14-15) for stickiness, satisfactory quality grade (22-23) for tenderness and questionable quality grade (15-16) for appearance, color and flavor.

The same results also indicated that addition of gel monoglyceride at level of 6% lead to produces spaghetti having satisfactory quality grade for appearance, color and flavor; while having questionable quality grade for tenderness and stickiness.

The same trend was also observed with addition of 18% of gel monoglyceride. However, addition of 12% of the gel monoglyceride in production of spaghetti with excellent quality grade for tenderness and stickiness while, appearance, color and flavor were found to have satisfactory quality grade.

Table (21): Effect of addition of monoglyceride gel to wheat flour 72% extraction on sensory evaluation of spaghetti.

Treatment		Appearance	Color	Flavor	Tenderness	stickness	Overall acceptability
		20	20	20	25	15	100
Wheat flour (control 1)		14.0c	16.5b	16.0b	12.0b	6.0c	64.5e
Gel of	6%	17.0b	17.0b	16.0b	16.0a	5.0d	71.0d
	12%	18.5a	18.5a	16.0b	19.0a	13.5a	85.5b
	18%	14.5c	16.0b	15.5b	18.5a	10.5b	75.0c
Semolina (cont. 2)		19.0a	19.0a	19.0a	19.5a	13.5a	90.0a
L.S.D		1.08	1.03	1.25	3.69	0.92	1.96

***The mean scores of the same letter or letters are not significantly different at level 5%.**

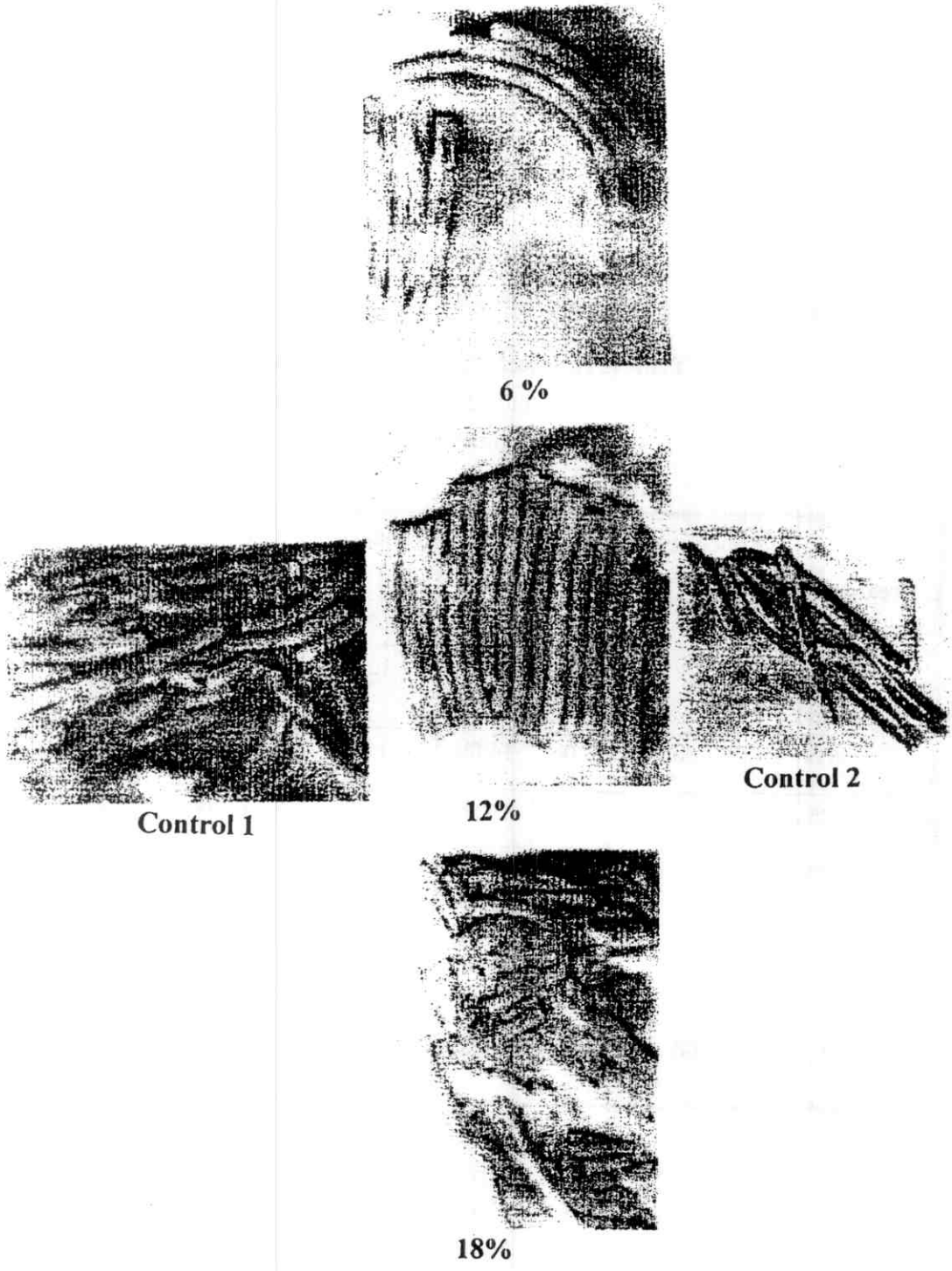


Fig (20): Spaghetti made From wheat flour (control 1), With different levels of Gel monoglyceride and semolina (control 2)

However, no significant difference was found between spaghetti made from 12% gel monoglyceride and spaghetti made from semolina for tenderness and stickiness. On the other hand, spaghetti made from semolina showed the highest scores for overall acceptability after that 12% of gel monoglyceride, after that 18%, 6% and spaghetti made from wheat flour without addition respectively.

The same results also indicated that there was significantly different between spaghetti made from semolina (control 2), spaghetti made from wheat flour 72% extraction without addition (control 1) and spaghetti made from wheat flour 72% extraction with additions for overall acceptability.

4.6.2. Effect of Noopazyme enzyme:

The results presented in Table (22) showed the effect of addition of Noopazyme enzyme to wheat flour (72% extraction) at level of 0, 100, 200 and 300ppm on spaghetti quality compared with spaghetti made from semolina. From these results it could be observed that addition of Noopazyme enzyme to wheat flour lead to produce spaghetti having satisfactory quality grade for most sensory properties at 200 ppm addition level which was found to have the highest scores after spaghetti made from semolina, no significant difference was observed between spaghetti made from wheat flour with 200ppm addition and 300ppm addition for overall acceptability.

However, significant difference was observed between spaghetti made from semolina (control 2), spaghetti made from wheat flour without addition (control 1) and with addition for overall acceptability.

Table (22): Effect of addition Noopazyme enzyme to wheat flour 72% extraction on sensory evaluation of spaghetti

Treatment		Appearance	Color	Flavor	Tenderness	stickness	Overall acceptability
		20	20	20	25	15	100
Wheat flour (control 1)		14.0c	16.5b	16.0b	12.0b	6.0c	64.5d
Wheat flour + Noopazyme	100ppm	17.0ab	15.5b	13.5d	19.0a	9.5b	74.5c
	200ppm	17.0b	17.0b	14.0cd	19.5a	11.0b	78.5b
	300ppm	17.0b	16.5b	15.0bc	18.5ab	10.5b	77.5b
Semolina (cont. 2)		19.0a	19.0a	19.0a	19.5a	13.5a	90.0a
L.S.D		1.92	1.75	1.34	6.7	1.44	2.51

***The mean scores of the same letter or letters are not significantly different at level 5%.**

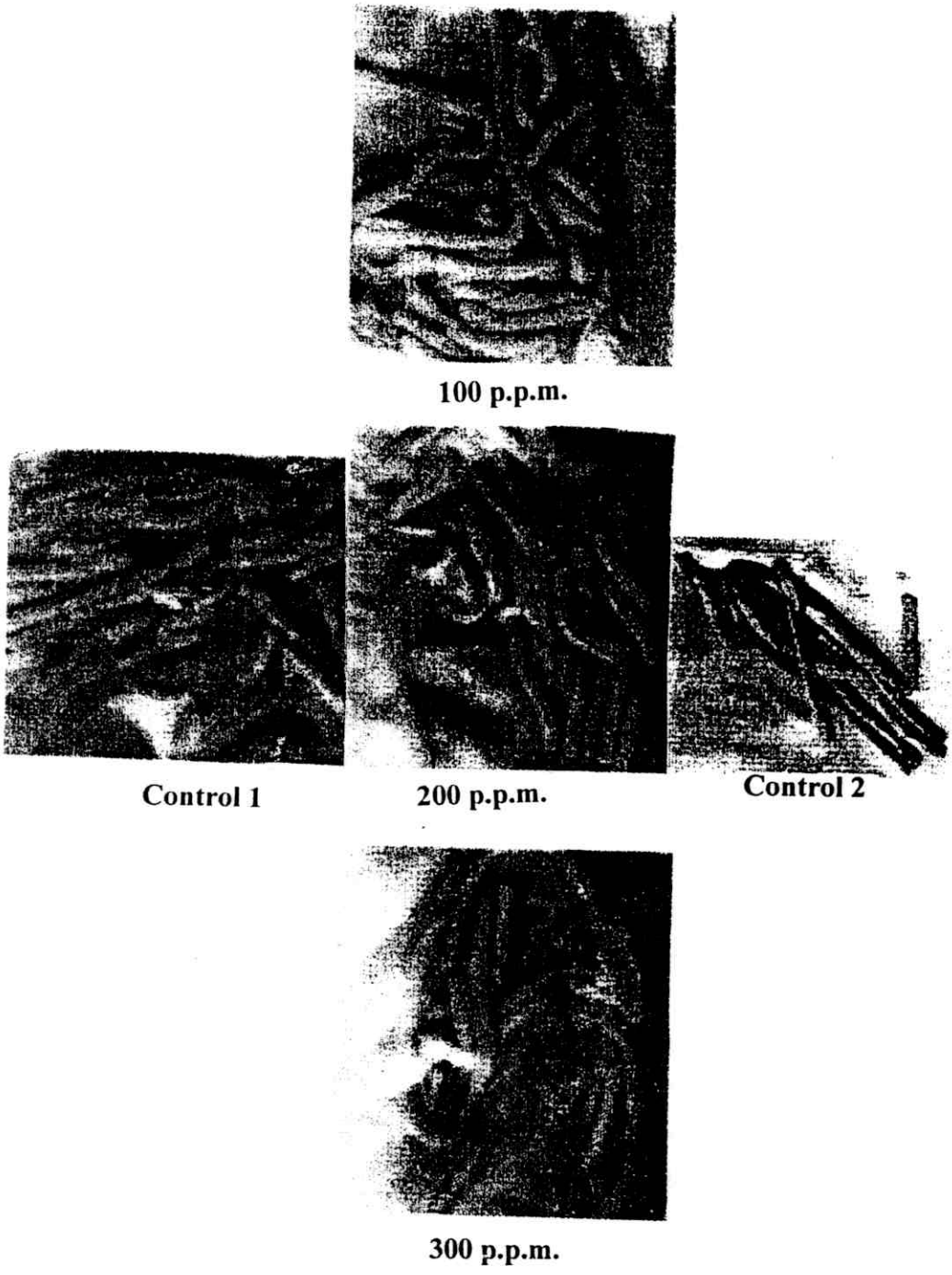


Fig (21): Spaghetti made from wheat flour (control 1), with different levels of noopazyme enzyme and semolina (control 2).

These results also was found to be in agreement with those of STRACHEN (2002) . who reported that noopazyme enzyme is a lipase that improves the overall quality of noodles or wheat based products as follows : (Reduces the stickiness of over cooking noodles and pasta).and (Increases the brightness of cooking and pasta)

4.6.3. Effect of ascorbic acid with glucose oxidase enzyme:

Ascorbic acid with glucose oxidase was added to wheat flour (72% extraction) at levels of 0, 300, 600 and 900 ppm and the effect of these additions on sensory properties of spaghetti was studied compared with spaghetti made from semolina.

The results presented in Table (23) indicated that no significant difference was observed for overall acceptability between spaghetti produced with addition of ascorbic acid with glucose oxidase at levels 300ppm and 600 ppm for overall acceptability. While there was significant difference between control 1 sample (spaghetti made from wheat flour 72% extraction), other treatments and spaghetti made from semolina. However, in both cases, spaghetti produced with addition of 900ppm ascorbic acid with glucose oxidase showed the highest scores after spaghetti made from semolina, while the control 1 samples (spaghetti made from wheat flour 72% extraction) showed the lowest scores.

Table (23): Effect of addition ascorbic acid and glucose oxidase enzyme to wheat flour 72% extraction on organoleptic characteristic of spaghetti

Treatment		Appearance	Color	Flavor	Tenderness	stickness	Overall acceptability
		20	20	20	25	15	100
Wheat flour (control 1)		14.0b	16.5b	16.0b	12.0c	6.0c	64.5d
Ascorbic acid	300ppm	15.5b	15.0b	14.5b	16.0b	10.0b	71.0c
	600ppm	14.0b	15.5b	15.0b	18.5ab	10.5b	73.5b
	900ppm	15.5b	15.0b	15.0b	19.0ab	11.0b	75.5b
Semolina (cont. 2)		19.0a	19.0a	19.0a	19.5a	13.5a	90.0a
L.S.D		1.76	1.59	2.17	2.41	1.23	2.44

***The mean scores of the same letter or letters are not significantly different at level 5%.**

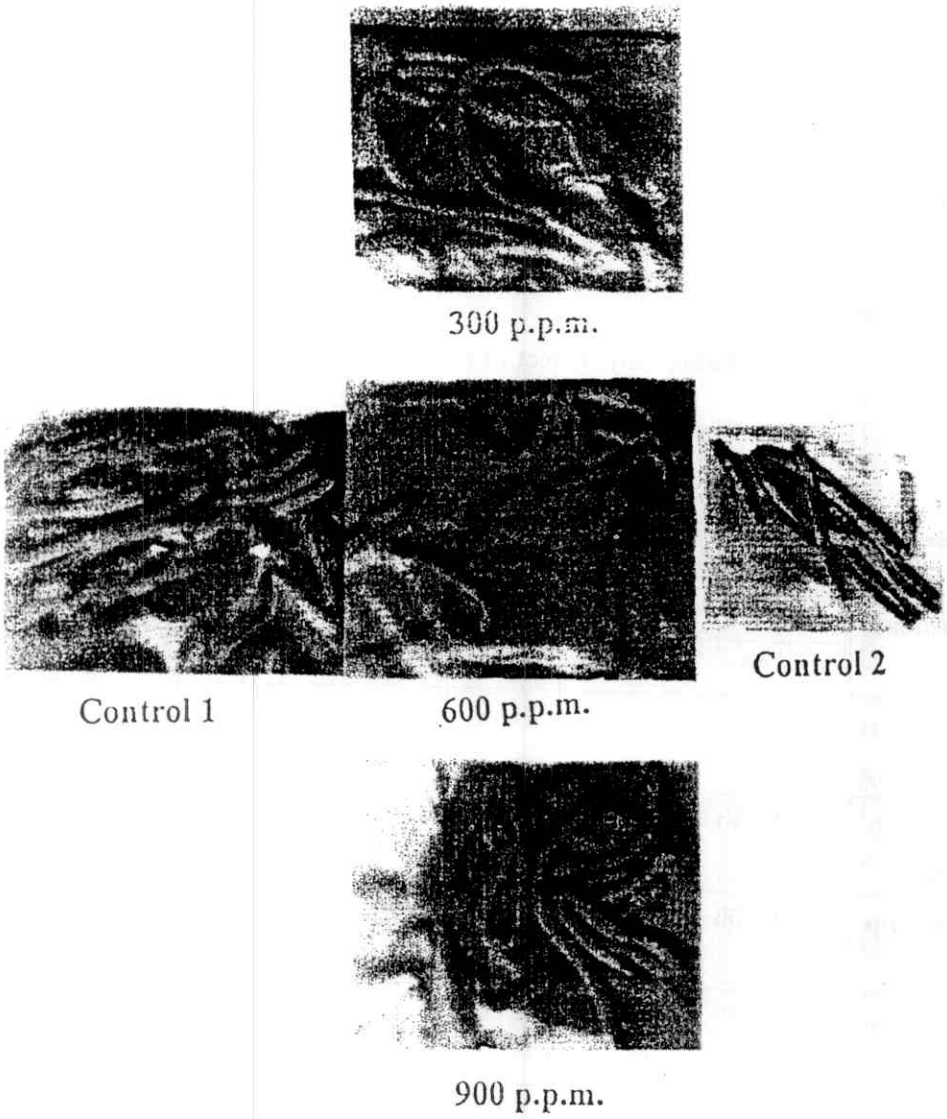


Fig (22): Spaghetti made from wheat flour (control 1), with different levels of ascorbic acid with glucose oxidase enzyme and semolina (control 2).

These results was also found to be in agreement with those of (BAKES et al 1994) who reported that ascorbic acid improves the overall acceptability and decreased stickiness for spaghetti also (NAKOI et al 1995) found that addition of glucose oxidase enzyme to wheat flour improved the overall acceptability for pasta produced and a firm pasta with non sticky produced by addition glucose oxidase enzyme .