4. RESULTS AND DISCUSSION

4.1. Chemical composition of sweet lupin seed flour, chickpea seed flour and common bean seed flour:

4.1.1. Gross chemical composition:

Data in Table (1) showed that, the chemical composition of sweet lupin seed flour, chickpea seed flour and common bean seed flour. The protein content of the sweet lupin seed flour was higher (30.11%) than both chickpea seed flour and common bean seed flour (20.9%, 24.6%, respectively). This finding may focus the interest of utilizing sweet lupin seed flour as a high protein source in some food formulation. Meanwhile, carbohydrate content of the chickpea seed flour was (57.82%) which was higher than both sweet lupin seed flour and common bean seed flour (38.92%, 54.03%, respectively). Comparing out with previous investigators, **Campos and El-Dash (1978) and Ballester** *et al.* **(1980).** The species of sweet lupin, *Lupinus albus* and *Lupinus luteus,* were analyzed. Both species were good sources of protein (39%), **El-Makhzangy** *et al.* **(1989)** for *Lupinus albus* flour (46.6%), **Chango** *et al.* **(1993)** for *Lupinus lateus* (38.0%), **Laqari** *et* **a/. (2002)** for *Lupinus mutabilis* with (44.6%) protein content. it is clear that, the obtained results are less in protein and carbohydrate than other.

The protein content of the chickpea seed flour was (20.9%). These results were slightly lower than those reported by **Khan** *et aL* **(1979)** and **Chavan** *et al.* **(1989)** (from 21.4 to 29.4%, respectively.

Table (1): Chemical composition of raw materials, sweet lupin seed flour, chickpea seed flour and common bean seed flour [on fresh weight basis].

Raw materials %	Sweet lupin seed flour	Chickpea seed flour	Common bean seed flour
Moisture	11.04	11.62	11.32
Protein	30.11	20.9	24.6
Fiber	19.97	14.67	15.04
Ash	3.00	2.47	3.95
Fat	6.49	3.11	1.13
Carbohydrate	38.92	57.82	54.03

The protein content of the common bean seed flour was (24.6%) these results like **Roberto *et al.* (1971)** for 25%, while this result is slightly lower than that reported by **Nwokolo and Smartt (1996),** 22.9%.

The fat content of sweet lupin seed flour 6.49% these result were higher than fat content of chickpea seed flour and common bean seed flour, 3.11%, 1.13%, respectively.

Elemental composition of sweet lupin seed flour chickpea seed flour and common bean seed flour are shown in Table (2).

The minerals K, Na and Ca were the major inorganic constituents of the ash in all studied samples (7941 mg/k.gm, 383.4mg/k.mg and 5362 mg/k.gm, respectively).

Therefore, lupin seed its flour could be used as supplementation for cereal flour to improve its content from Ca. **Muzquiz *et al.* (1989), Dagnia *et al.* (1992).** Among the trace element of zinc in sweet lupin seed flour, chickpea seed flour and common bean seed flour, the values limits advised for nutrition (36.8 mg/k.gm; 41.52 mg/k.gm; 47.38 mg/k.gm). Phosphours and potassium results are higher (3147 mg/k.gm; 2909 mg/k.gm; 6229 mg/k.gm; 7941 mg/k.gm and 151610 mg/k.gm, respectively).

Hove (1974), Muzquize *et al.* (1989) and Dagnia *et al.* (1992), reported that Zn, Fe and Cu levels were comparable and advised for poultry nutrition and did not reach toxic **(ARC, 1967).** Generally, these values agree well with those reported by **Hove *et al.* (1978), Ballester *et al.* (1980), Muzquize *et al.* (1989) and Dagnia *et al.* (1992).**

Table (2): Minerals of raw materials, sweet lupin seed flour, chickpea seed flour and common seed flour (mg/kg) [on dry weight basis].

Raw materials	Minerals content (mg/kg)									
	Ca	Ph	Al	Cu	Fe	K	Mg	Mn	Na	Zn
Sweet lupin seed flour	5362	3174	47.39	9.9	195.2	7941	1578	8194	383.4	36.8
Chickpea seed flour	3346	2909	43.52	6.5	168.7	8140	1478	161.2	244	41.52
Common bean seed flour	1922	6229	37.19	0.434	185.2	15610	2710	181.3	418.6	47.38

Table (3): Antinutritional factors of sweet lupin seed flour, chickpea seed flour and common bean seed flour[on dry weight basis].

Antinutritional compounds	Sweet lupin seed flour	Chickpea seed flour	Common bean seed flour
Tannins %	0.389	0.276	0.382
Total alkaloids %	0.016	0.013	*
Phytic acid %	0.656	0.488	0.606
Trypsin inhibitor (TIU/mg protein)	22082	2120.283	3051.751

* Free from alkaloids.

Table (3) illustrates some antinutrifional compounds found in the sweet lupin seed flour, chickpea seed flour and common bean seed flour in their content from tannins, total alkaloids, phytic acid and typsin inhibitor, these results lower than that reported by El-Adawy (1986), Tannis in lupins in lupin seed flours approximately low (1.291.42%) compared to faba bean (1.68%) or other legume and oil seeds.

Generally, these values lower than that reported by Massoud (1992) and **Dupont** *et aL* (1994) ranged between (1.51-2.6%) and lower than that reported by **Rahma and Narasinga Rao** (1984) and El-Naggar (1994) for *Lupinus termis* (0.86-0.91%).

Khan *et aL* (1979) found that the tannins content in chickpea from 051 to 085%, its results higher than that (0.276%).

Total alkaloids content of sweet lupin seed flour and chickpea seed flour (0.016% and 0.013%) its lower than that reported by **Damir and Shekib (1989)** for *Lupinus termis* flour and **Dupont** *et aL* (1994) which found the total alkaloids content of five bitter seed varieties ranged from 0.48% to 1.69%. On the other hand, the sweet lupin seed flour content was 0.10% total alkaloids. The results are briefly considered in relation to toxicity and palatability of lupin seed for use as food. Generally these data agree with those reported by **Ruiz (1978), Gross** *et aL* **(1988) and Chango** *et aL* **(1993)** (0.003-3.17%).

The phytic acid content of sweet lupin seed flour, chickpea seed flour and common bean seed flour, 0.656%, 0488 and 0.606 respectively. It was lower than that of **Muzquize** *et al.*

(1989a) and Massoud (1992) the later author reported that the values of phytic acid were 2.0%. **Li *et al.*** (1989) for instance, with white kidney bean, the extent of hydrolysis of the crystalline isolate (2.37% phytate). On the other hand, with the navy bean, the extent of hydrolysis of the crystalline isolate (3.85% phytate) was lower than that of the amorphous isolate (7.59% phytate).

Trypsin inhibitor activity obtained results in sweet lupin seed, chickpea seed flour and common bean seed flour, 22.082, 2120.283 and 30.751, respectively. These results are higher than that stated by **Kim and Madhusudhan (1985),** the trypsin inhibitor activity of lupin seed flour was 14.4 TUUmg protein, **Nwokolo and Smartt (1996)** found that the lupin termis has shown to have a trypsin inhibitor of 1.16 Mimi. compared to 30.1 TIU/nd in soybean. **El-Kowicz and Sosulski (1980)** found that the trypsin inhibitor activity segregated with the fines during air classifican, the lima bean protein having a high value of 89.8 TUUmg.

4.1.2. <u>Amino acids composition:</u>

The results of amino acids of sweet lupin seed flour, chickpea seed flour and common bean seed flour are presented in Table (4). The total essential amino acids values of sweet lupin seed flours were 33.82 gm/16 gm N, chickpea seed flour 34.30 gin/16 gm N and common seed flour 34.70 mg/16 gm N, respectively. These results were nearly from the results reported by **Mironenko *et al.* (1973),** who reported that the total essential amino acids of 7 lupin seed varieties ranged from 35-37% from the total amino acids.

Table (4): Amino acids composition of sweet lupin seed flour, chickpea seed flour and common bean seed flour (gm amino acid / 16 gm nitrogen) [on dry weight basis].

Amino acid	Sweet lupin seed flour	Chickpea seed flour	Common bean seed flour
Isoleucine	4.00	4.02	4.05
Leucine	7.00	7.11	7.02
Lysine	4.60	4.62	4.81
Cystine	1.10	1.20	1.30
Methionine	0.86	0.84	0.89
Proline	3.81	3.92	3.96
Phenylalanine	4.84	4.92	4.93
Threonine	3.67	3.76	3.80
Valine	3.94	3.93	3.94
Histidine	3.39	3.42	3.60
Arginine	8.54	8.62	8.70
Aspartic acid	10.91	10.94	10.91
Glutamic acid	24.83	24.90	24.80
Serine	4.83	4.90	4.92
Glycine	4.24	4.11	4.13
Alanine	4.04	4.06	4.07
Total (E.A.A) *	33.82	34.30	34.70
Total (N.E.A.A) **	60.78	60.94	61.13

* E.A.A.: Essential amino acid.

** **N.E.A.A.:** Non-essential amino acid.

Gross (1982) found that the lupin protein is deficient in sulfur containing amino acids. Thus, supplementation of lupin seed flour by methionin may improve their amino acid profile and its biological value.

Total non-essential amino acids were high in common bean seed flour, chickpea seed flour and sweet lupin seed flour and constitute 61.16 mg/16 gin N; 60.95 mg/16 gm N; 60.78 mg/16 gm N, respectively. Chew ***et al.*** **(2003) found** that the essential amino acid compositions of the lupin kernel and the ISO and OF protein concentrates. All essential amino acids except for the sum of cysteine and methionine, which was slightly deficient.

4.2. Chemical composition of sweet lupin protein concentrate and protein isolate, chickpea protein concentrate and protein isolate, common bean protein concentrate and protein isolate:

4.2.1. Gross chemical composition:

The results of the chemical composition of lupin protein concentrate and protein isolate, chickpea protein concentrate and protein isolate, common bean protein concentrate and protein isolate are presented in Table (5).

These results were nearly from the results reported by **Sathe** ***et al.*** **(1982)** the protein concentrate of lupin protein concentrate had 78.80%, Chew ***et*** **a/. (2003)** the lupin kernels resulted in solubilisation of 87% isolate, **Ulloa (1988)** the protein recovered was 70% when the pH was increased to 7.0 the

Raw materials Contents	Sweet lupin		Chickpea seed		Common bean seed	
	Protein concentrate	Protein isolate	Protein concentrate	Protein isolate	Protein concentrate	Protein isolate
Moisture	4.74%	2.11%	5.92%	2.18%	5.96%	2.10%
Protein	73.17%	87.20%	76.82%	88.23%	71.92%	89.30%
Fiber	1.68%	00.52%	1.98%	00.63%	1.22%	00.60%
Ash	5.42%	3.12%	7.19%	3.45%	5.37%	3.00%
Fat	13.58%	6.10%	3.69%	3.48%	13.72%	5.00%
Carbohydrates	2.56%	2.35%	2.63%	2.43%	2.62%	2.38%

extraction was increased to 85%. The maximum extraction was 90% at pH 12 in chickpea. Lopex ***et al.*** (1991) the proteins were isolated from chickpea flour by micellization and isoelectric precipitation techniques, protein content ranged from 84.8-87.8%. **Vioque *et al.*** (1999) the percentage of protein recovered from in the preparation of isolates were 65.9 and 62.1, respectively. Bember ***et al.*** (1975) when isolated, contained the greatest protein content (61.04%). The isolated albumin fraction contained a lower protein content (75.98%) in navy bean. Meanwhile results from obtained, moisture, fiber, ash, fat and carbohydrate slight did not differences were observed between (lupin protein concentrate and protein isolate, chickpea protein concentrate and protein isolate, common bean protein concentrate and protein isolate.

4.3. Functional properties of sweet lupin seeds, chickpea seeds and common bean seeds:

4.3.1. Protein solubility:

The protein solubility of sweet lupin seed flour, chickpea seed flour and common bean seed flour was determined in 0.1 *M* sodium chloride. Data are shown in Table (6) and illustrated in Fig. (4). No differences between them. The highest protein solubility was obtained in 0.1 ***M*** sodium chloride. The sodium chloride solubilize albumins and globulins, but sodium hydroxide extracts albumins, globulins and other protein fractions such as prolatnins and glutilines **(EI-Adawy *et al.*,** 1999). Our results are lower than those reported by **Rahma and Narasinga (1984) and El-Naggar (1997)** for protein solubility index of *Lupinus fermis* in salt and alkaline solution.

Table (6): Protein solubility of sweet lupin seed flour, chickpea seed flour and common bean seed flour in 0.1M sodium chloride[on dry weight basis].

Solvent	Sweet lupin seed flour	Chickpea seed flour	Common bean seed flour
0.1 ***M*** sodium chloride	78.45%	76.32%	74.53%

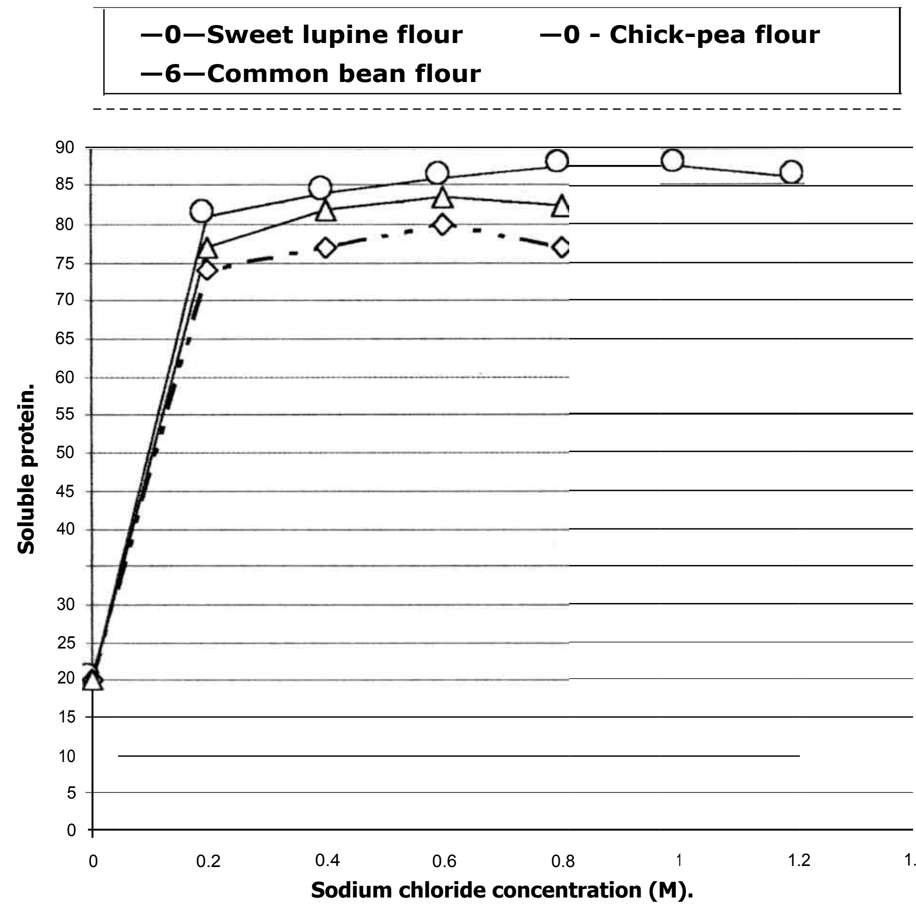


Fig. (4): Effect of sodium chloride on the extracted protein of sweet lupine seed flour, chick-pea seed flour and common bean seed flour.

Generally, protein solubility is known to increase with increasing moderate salt concentrations due to the salting-in effect and at a higher salt concentrations the protein solubility does not increase, as there is likely to undergo salting-out. These results agree with the results obtained by Ruiz and Hove (1976).

Generally, this observation obtained in this study was study was similar to those reported by sgrarbiei and Galeazzi (1978), the solubility is very steep from pH 4.5 to near neutrality reaching 70% at pH 6.0. The solubility continues to increase to levels of 80-85% at pH 9.0, the proteins were precipitated from the remaining supernatant by adding trichloracetic acid in sweet lupin seed flour. While El-Makhzangy ***et aL*** (1989) found that the solubility is greater than 50 and 75% at pH 1 for the whole and defatted flours. Bencini (1986) the chickpea proteins had a point of minimum dispersion at pH 4.0 (Ca 10% nitrogen solubility) and their solubility increased at lower and higher pH values, 91% solubility obtained at pH 9.8. Klepacka ***et*** (1996) the protein, salt-soluble nitrogen amino groups and moisture contents samples of bean and pea flour contained 25-28% and lupin flour 34-41% protein on a dry basis; the protein contents were 76-86% in unmodified samples and 65-82% (dry weight basis) in acylated samples.

4.3.2. <u>Water absorption capacity:</u>

The water absorption of sweet lupin seed flour, chickpea seed flour and common bean seed flour is shown in Table (7). Sweet lupin flour, chickpea flour and common bean seed flour were 136.1, 130.2 and 129.4 gm H_2O / 100 gm flour, respectively. Generally, these results confirm well with those

Table (7): Water and fat absorption capacities of sweet lupin seed flour, chickpea seed flour and common bean seed flour[on fresh weight basis].

Properties	Sweet lupin seed flour	Chickpea seed flour	Common bean seed flour
Water absorption capacity (gm/100 gm)	136.1	130.2	129.4
Fat absorption capacity (gm/100 gm)	160.3	158.7	155.8

reported by Abdeen (1987) for lupin seed flour, Who found the water absorption capacity value was 135 gm/100 gm flour.

On the other hand water absorption by the seed flour and the protein concentrate in the present investigation were higher than that for the Great Northern bean flour (1 g/g) Sathe anf Salunkhe (1981) but was lower than those of soybean flour (2.4 g/g), soybean concentrate (3.6 g/g).

In addition, may be the conformation features of the protein caused these differences in water absorption capacity, also some other chemical compounds rather than protein particularly starch and crude fibre may take place in water binding capacity.

4.3.3. <u>**Fat absorption capacity:**</u>

The fat absorption of sweet lupin seed flour, chickpea seed flour and common bean seed flour is shown in Table (7). The fat absorption capacity was 160.3, 158.7 and 155.8 gm oil/100 gm flour for sweet lupin seed flour, chickpea seed flour and common bean seed flour and common bean seed flour respectively.

These results are higher than those reported by **Abdeen (1987) for** *Lupinus terims* seed flour. Because these lupin seed flours had different protein contents, fat absorption capacity was also calculated according to their protein content. Bitter lupin seed flour was higher in absorbing oil than sweet lupin seed flours, respectively. Generally, more hydrophobic proteins show superior binding of lipids **(Kinsella, 1976).** According to that, nonpolar amino acids chains bind the paraffin chains of fats. The nonpolar amino acids content was 28.19 and 28.22 gm /100 gm protein for bitter and sweet seed flour proteins, respectively. Also, as it was observed for polar group contents, the difference in nonpolar residues was not marked. Also, interaction due to that sodium chloride had saturated almost all of the active centers of the proteins under investigation.

4.3.4. Emulsification capacity:

The effect of sodium chloride concentration on emulsification capacity of lupin seed flour, chickpea seed flour and common bean seed flour is presented in Fig. (5). There was an observed increase in emulsification up to 0.8 M then decreased. The maximum emulsification capacity values were 90.4, 88.3 and 84.5 ml oil/gm protein for sweet lupin seed flour, chickpea seed flour and common bean seed flour respectively. At the optimum concentration of sodium chloride (0.8 M). These values agree well with those reported by **Sathe** *et al.* **(1982)** for *Lupinus mutabilis* seed flours in distilled water (55 ml oil / gm). Emulsification capacity is known to increase with increasing moderate salt concentration due to salting-in effect of the proteins. At higher salt concentrations the emulsification capacity does not increase as there is likely proteins undergo salting-out effect.

4.3.5. Foaming *capacity:*

Fig. (6) shows the effect of sodium concentration on the foam capacity of sweet lupin seed flour, chickpea seed flour and common bean seed flour in the range of 0.0 to 1.2 *M* sweet lupin seed flour, chickpea seed flour and common bean seed flour, the foam capacity increased with sodium chloride concentration to

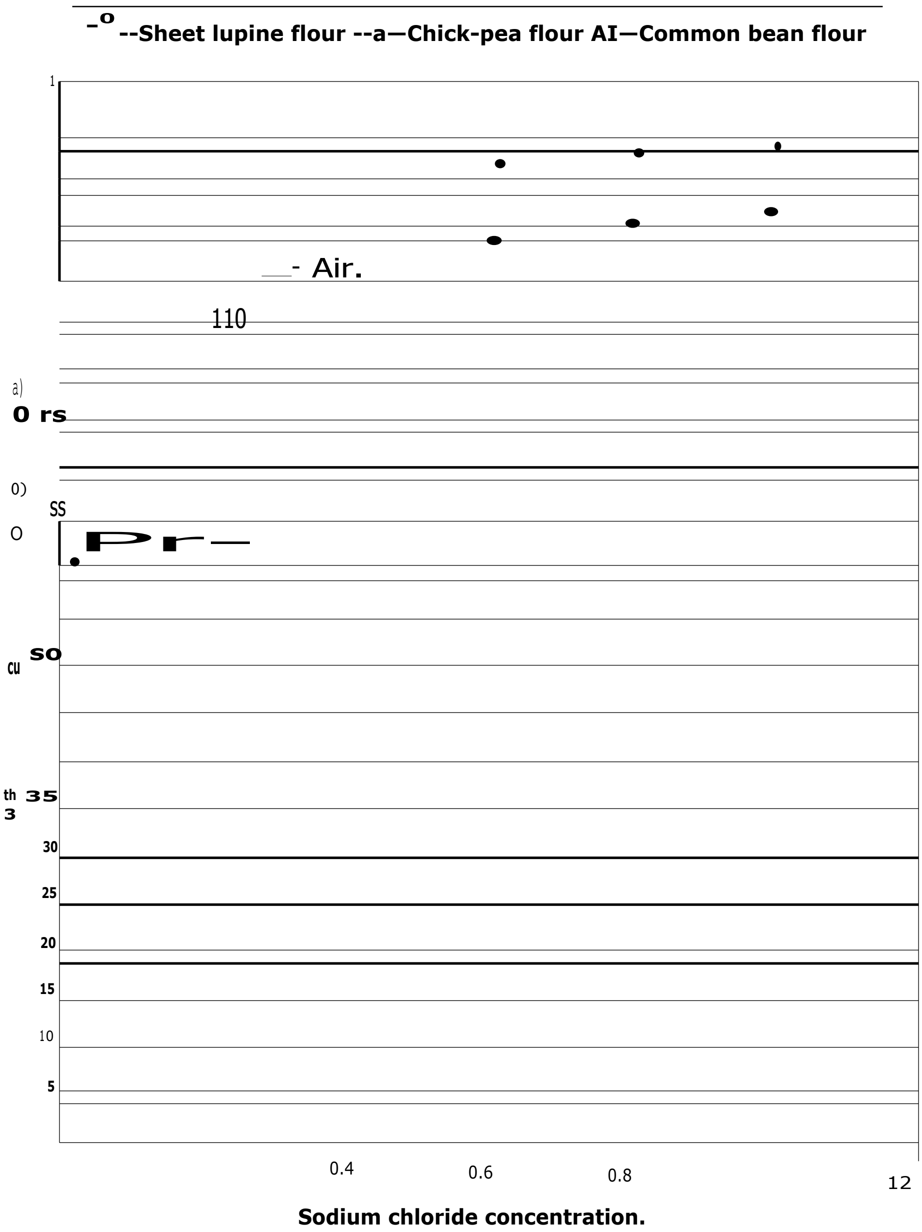


Fig. (5): Effect of sodium chloride on the emulsification capacity of sweet lupine seed flour, chick-pea seed flour and common bean seed flour.

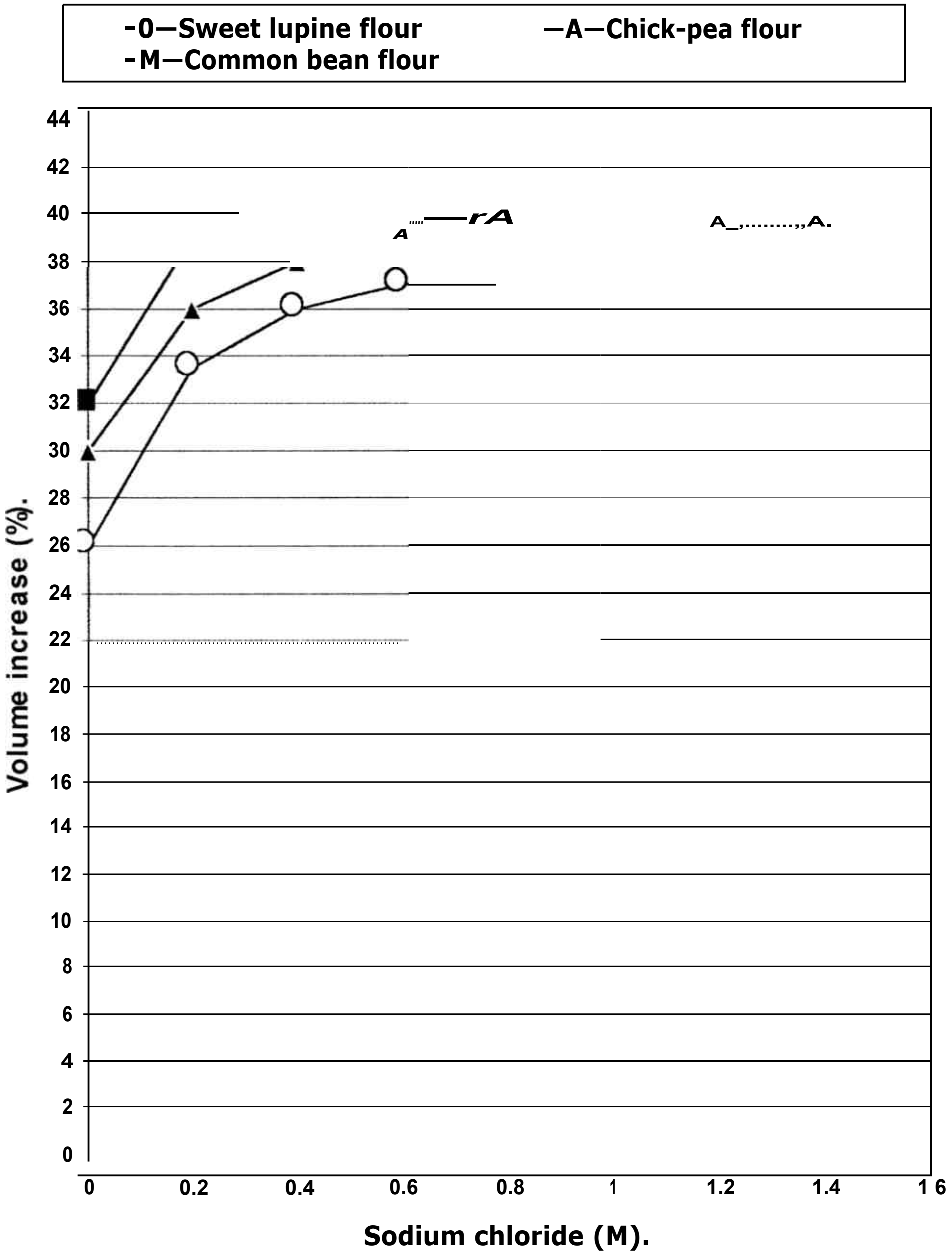


Fig. (6): Effect of sodium chloride on the volume increase (%) of sweet lupine seed flour, chick-pea seed flour and common pea seed flour.

a maximum value and then decreased. Foam capacity values of sweet lupin seed flour, chickpea seed flour in water were 26, 30 and 32%, respectively. Generally, these values agree well with those reported by Sathe ***et al.*** (1982).

The maximum foam capacity occurred at 0.8 ***M*** sodium chloride for sweet lupin seed flour, chickpea seed flour and common bean seed flour. Foam capacity pattern of sweet lupin seed flour, chickpea seed flour and common bean seed flour was similar to their protein solubility pattern in sodium chloride solution. El-Adawy ***et aL*** (1999a) found a similar observation for foam capacity.

4.4. Utilization of sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds protein concentrate:

4.4.1. Replacement of pan bread blends with sweet lupin seeds protein concentrate, chickpea seeds protein and common bean seeds protein concentrate:

Wheat flour of 72% extraction was supplemented with sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds protein concentrate used were prepared by cold process. Addition of sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds concentrate was 10, 20 and 30 percent. The straight dough method was conducted to find out the best formula of pan bread to be prepared.

The effect of addition of sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds protein concentrate to wheat flour at the various required pucentages on the rheological properties of wheat dough was evaluated using Brabender Farinograph and Extensograph. Data obtained are presented in Table (8).

4.4.2. <u>Farinograph tests:</u>

As presented in Table (8) the wheat flour used of 53.9% water absorption, while those replacement with sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds flour as illustrated in Figs. (7, 8 and 9) data were revealed higher percentages, as they were 58.0, 58.8, 61.5, 56.8, 57.3, 58.8, 57.6, 58.7 and 60.3 in wheat flour replacement with 10, 20 and 30% three legumes at the same levels, respectively. Such increase in water absorption could be attributed to increase in protein due to addition of sweet lupin seeds protein, chickpea seeds protein concentrate and common bean seeds protein concentrate to wheat flour. Data obtained are in agreement with those reported by **El-Farra** ***et al.*** (1982). As shown in Table (8) that there were increasing of protein absorbed by water. Mixing time and dough stability in min. took the same trend as water absorption, hence they increased gradually by increase of sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds protein concentrate percentages in wheat dough.

On the contrary, the dough weakening in brabender units decreased due to higher percentages of water present. It could be mentioned that addition of sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds

Table (8): Farinograph and extensograph parameters of wheat flour dough after addition of sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds prctein concentrate.

Result Sample		Farinograph					Extensograph			
		W.A (%)	A (min)	B (min)	C (min)	D.S (min)	S (B.U)	E (m.m)	P.N	Energy (cm)
Control		53.9	1.0	2.0	6.0	85	390	140	2.79	52
1	**10%**	580	1.5	3.5	5.0	95	260	145	1.8	46
	20%	58.8	1.5	3.0	4.0	110	225	120	2.13	38
	30%	61.5	3.0	4.0	3.0	150	200	145	1.37	35
2	**10%**	56.8	1.5	2.0	5.5	35	340	105	3.3	44
	20%	57.3	2.0	3.0	5.0	80	230	110	**2.1**	**27**
	30%	58.8	2.5	4.0	4.0	110	230	40	2.6	24
3	**10%**	57.6	1.0	4.0	5.5	20	270	135	2.0	46
	20%	58.7	1.5	4.0	4.5	100	265	135	1.96	45
	30%	**60.3**	**2.5**	**4.0**	**4.0**	110	220	90	3.6	38

‹1): Common bean of protein concentrate; (2): Chickpea protein concentrate; (3): Sweet lupin protein concentrate

W.A : Water absorption % ; A: Mixing time (min); B: Developmental time (min); C: Dough stability (min); D.S: Degree of softening (min); B.U.: Brabender unit.; S: Extensibility; E: Elasticty; P.N: Proportional number

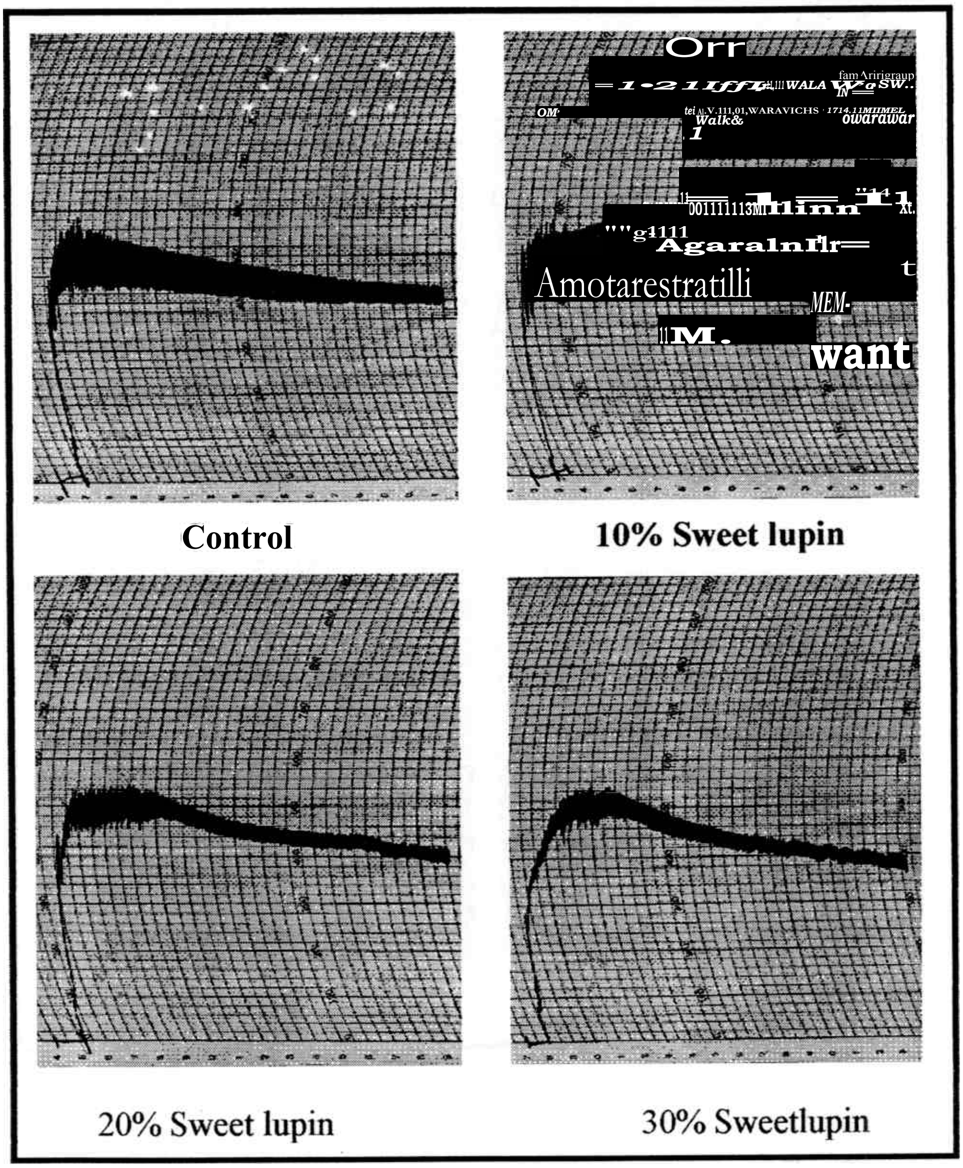


Fig. (7): Farinograms of different levels of sweet lupin seeds protein concentrate.

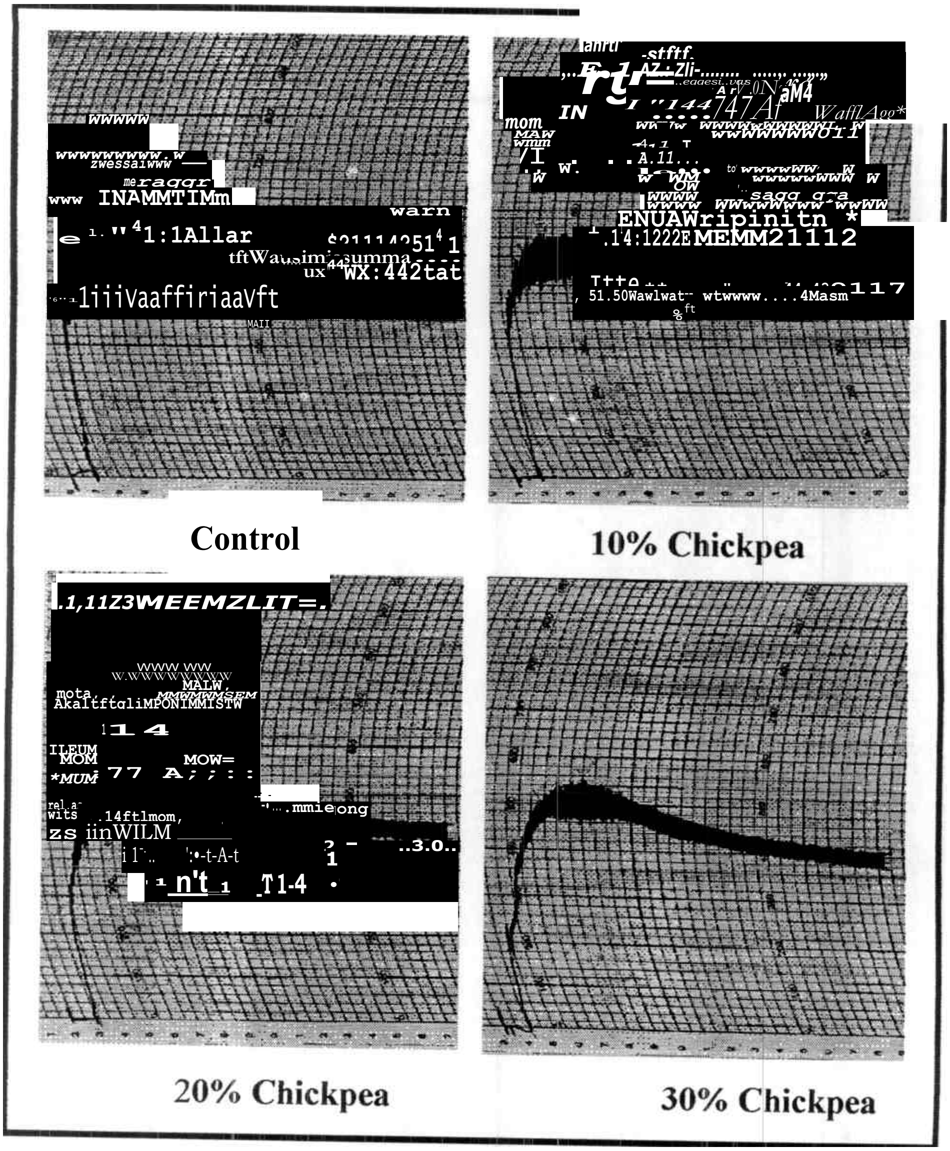


Fig. (8): Farinograms of different levels chickpea seeds protein concentrate.

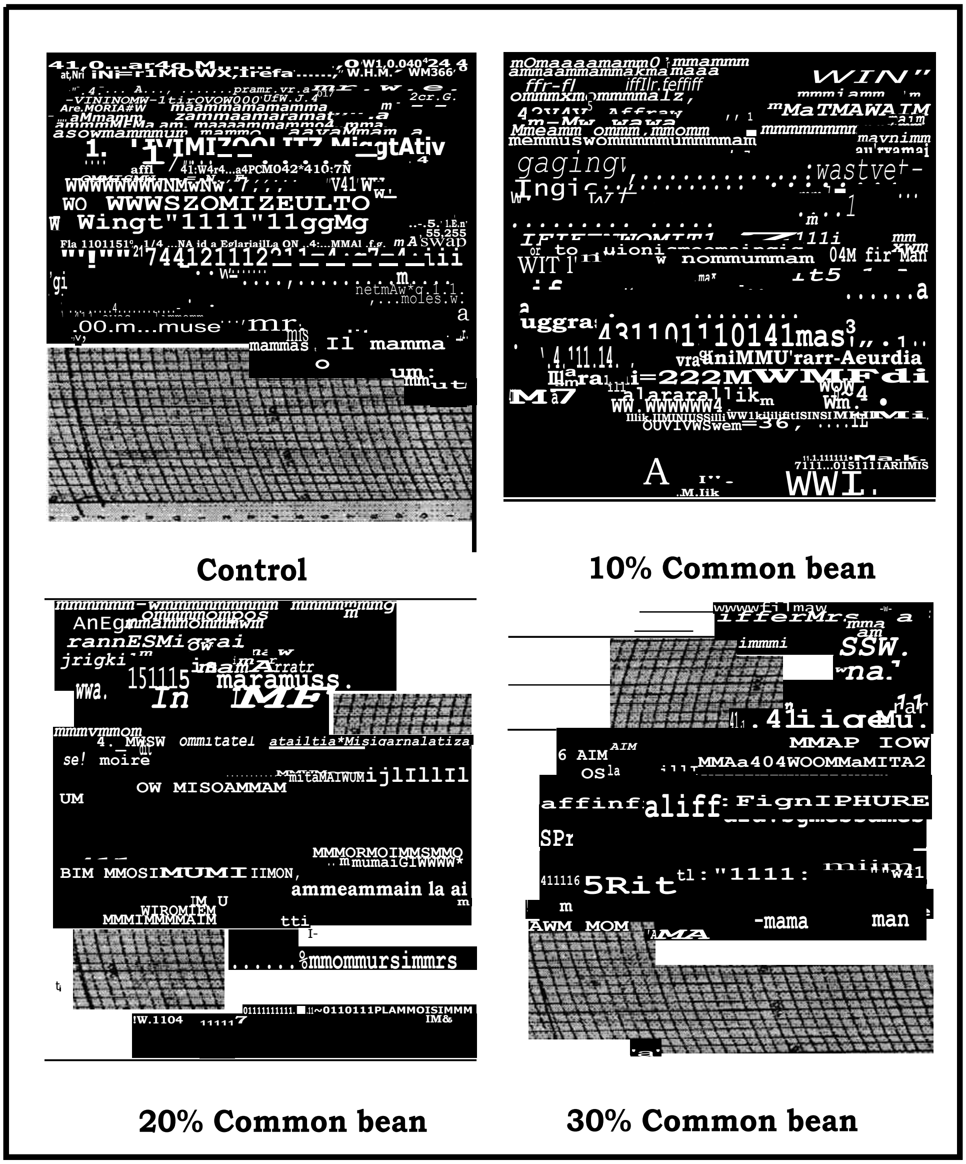


Fig. (9): Farinograms of different levels of common bean seeds protein concentrate.

protein concentrate improved the dough characteristics of replacement wheat flour which strengthed the gluten network upon mixing. These results coincide with those reported by **El-Farra *et al.* (1982) and James (1994).**

4.4.3. <u>Extensograph tests:</u>

Wheat flour replacement with different percentages of sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds protein concentrate showed various extensograph parameters for wheat dough as shown in Table (8). When percentages of 10, 20 and 30% of sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds protein concentrate wheat added to what flour the dough energy fluctuated between 46, 44 and 46 (cm^2), while 20%, 30% in all protein concentrates were lower than that of control (38, 35, 27, 24, 45 and 38 (cm^2).

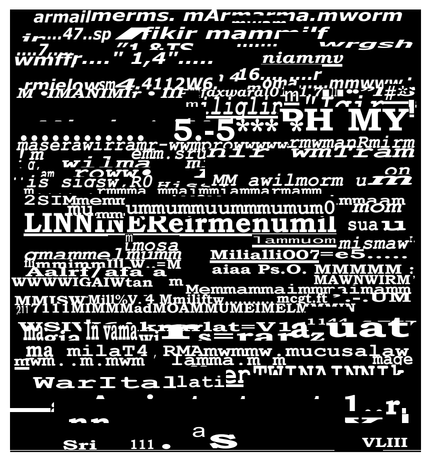
Therefore, it might be mentioned that addition of 10% and 20% of sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds protein concentrate was the most suitable o improve the nutritional value of wheat flour. Addition of common bean seeds protein concentrate (10%, 30%), chickpea seeds protein (10%, 20%) and sweet lupin seeds protein flour (10%, 20%) at all concentrations to wheat flour decreased their extensibility (E), as they fluctuated (145, 150), (105, 110) and (135, 135) mm.

Resistance of extension (S) of wheat flour took another direction as it was 390 B.U. and fluctuated between 200 and 340 B.u. after such addition.

Control

10% Sweet lupin

20% Sweet lupin



30% Sweet lupin

Fig. (10): Extensograms of different levels of sweet lupin seeds protein concentrate.

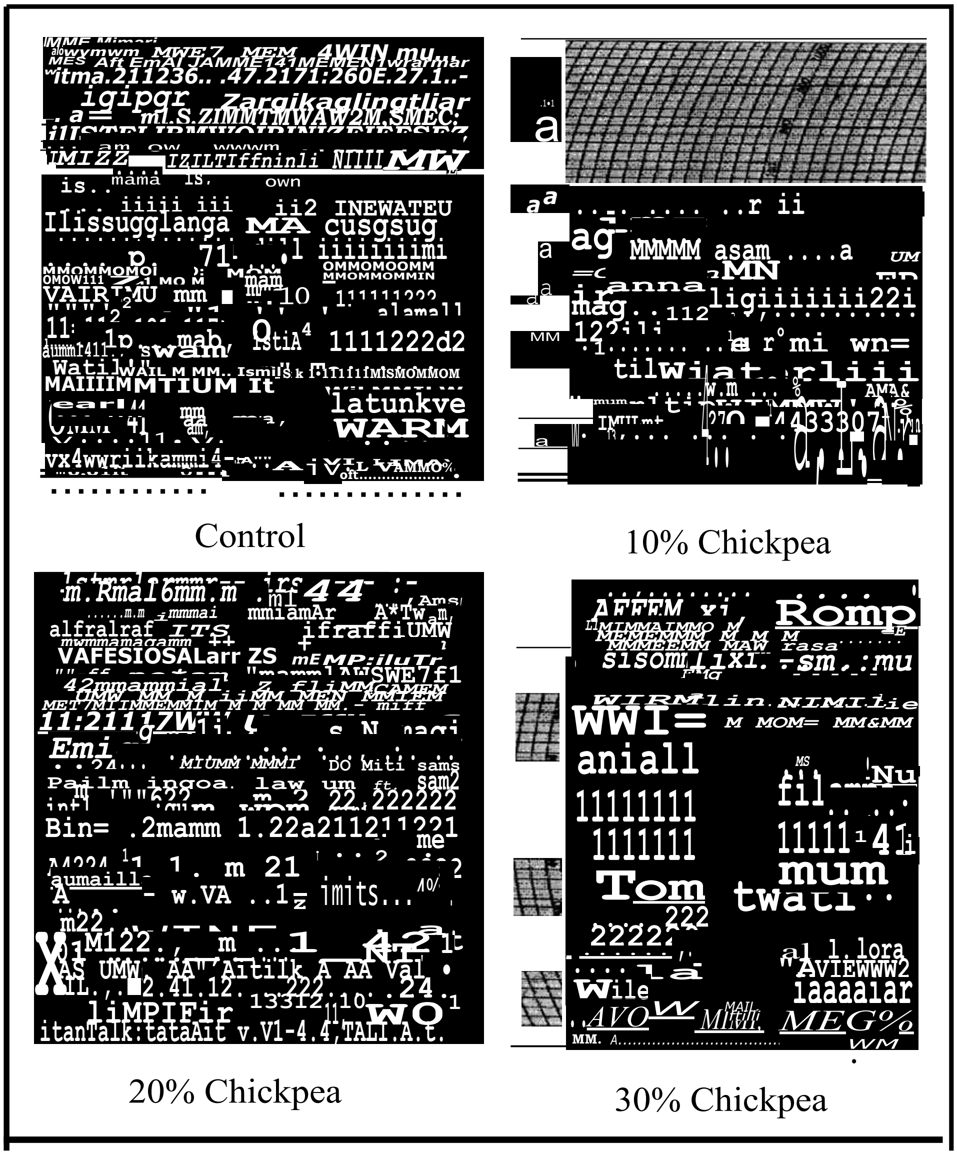


Fig. (11): Extensograms of different levels of chickpea seeds protein concentrate.

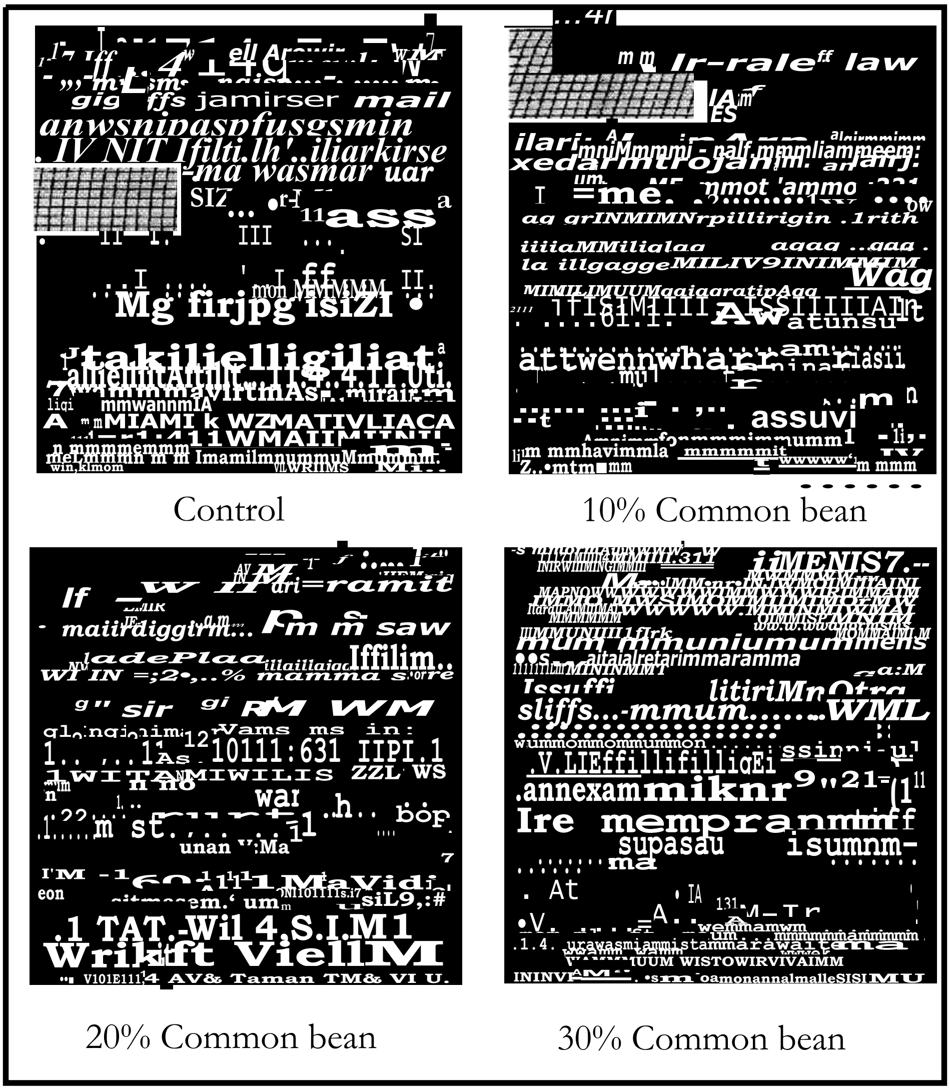


Fig. (12): **Extensograms of different levels** of common bean seeds protein concentrate.

Therefore, it could be mentioned that the proportional number (RN.) recorded variable values (decrease and increase) after addition of sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds protein concentrate to wheat flour. However, addition of 10% or 20% of three legumes revealed the lower proportional number, except chickpea protein concentrate 10% and sweet lupin seeds protein concentrate 30% was recorded higher values.

4.4.4. Pan bread product:

4.4.4.1. Physical properties of pan bread replacemented with sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds protein concentrate prepared by cold process:

Pan bread replacemented with 10, 20 and 30% protein concentrates of sweet lupin, chickpea and common bean prepared by cold process was organoleptically evaluated by ten panelists using the following scores:

15 for general appearance

20 for taste

40 for distribution of crumb

20 for odor

5 for crust

The results presented in Table (9) and illustrated in Figs (13, 14 and 15) indicated that substitution of the three legumes protein concentrate at different levels i.e. 10, 20 and 30% affected the general appearance, flavor, crumb and crust of the pan bread. The more effect was observed at the highest levels of substitution (i.e. 30%), followed by pan bread containing 10% chickpea, 10% common bean and 10% sweet lupin. The reduction was obvious in bread containing 30% of sweet lupin followed by 30% common bean. He decrease in acceptability by three legumes addition compared to the bread loaves produced from wheat flour may be attributed to the difference between wheat and the three legumes flour.

The bread specific volume showed a significant difference. Control loaves were greater in loaf specific volume followed by 10% chickpea and sweet lupin.

The mean values were statistically analyzed as presented in Table (9). The results showed no significant difference (in overall acceptability) between control pan bread and pan bread made by 10% chickpea concentrate and 10% common bean concentrate, while a significant difference was shown in pan bread made by 10% sweet lupin concentrate. Pan bread made by 20% chickpea concentrate, common bean concentrate and sweet lupin concentrate had the same significant degree, followed by 30% chickpea protein concentrate, 30% common bean concentrate and 30% sweet lupin protein concentrate of the pan bread made has no significant difference. There is a significant difference in flavor (taste and odor), 10, 20 and 30%.

Samples		General appearance			Flavor						Crust		
		Color	[illegible]	Volume	Taste	[illegible]	Texture						
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
-fc	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
al	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
u	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]				[illegible]		[illegible]	[illegible]	[illegible]	[illegible]		[illegible]

Table (10): Chemical composition of pan bread replacement with sweet lupin seeds protein, chick-pea seeds protein concentrate and common bean seeds protein concentrate (on fresh weight basis).

Treatment		Total chemical constituents % (Mean + S.D.)					
		Moisture	Protein	Fiber	Ash	Fat	Carbohydrate
Sweet lupin seeds protein concentrate	Control	2.12 ± 0.18 bc	9.72 ± 0.28 a	2.12 ± 0.13 a	3.05 ± 0.17 a	5.03 ± 0.13 a	77.02 ± 3.4 a
	10%	2.03 ± 0.1 c	13.8 ± 5.2 a	1.64 ± 0.16 b	3.33 ± 0.17 ab	3.62 ± 0.18 c	72.82 ± 2.18 a
	20%	2..52 ± 0.2 ab	14.02 ± 2.08 a	1.82 ± 0.13 b	3.43 ± 0.7 a	3.82 ± 0.13 be	72.6 ± 2.07 a
	30%	2.8 ± 0.4 a	14.12 ± 1.88 a	1.93 ± 0.17 ab	3.62 ± 0.28 a	3.94 ± 0.16 b	73.09 ± 0.91 a
L.S.D. (0.05)		* 0.464	ns 5.568	* 0.279	* 0.354	* 0.285	ns 4.356
Chick-pea seeds protein concentrate	Control	2.12 ± 0.18 c	9.72 ± 0.28 b	2.12 ± 0.13 a	3.05 ± 0.17 b	5.03 ± 0.13 a	77.02 ± 3.4 a
	10%	5.53 ± 0.07 b	11.62 ± 0.88 a	1.32 ± 0.08 c	3.19 ± 0.31 ab	3.82 ± 0.18 b	74.11 ± 0.89 ab
	20%	5.62 ± 0.2 b	11.82 ± 0.48 a	1.46 ± 0.14 be	3.39 ± 0.11 ab	3.93 1 0.22 b	72.52 ± 1.48 b
	30%	6.32 ± 0.35 a	12.02 ± 0.98 a	1.62 ± 0.18 b	3.57 ± 0.13 a	3.99 ± 0.21 b	73.02 ± 1.98 ab
L.S.D. (0.05)		* 0.421	* 1.346	* 0.258	Ns 0.369	* 0.355	ns 4.045
Common bean seeds protein concentrate	Control	2.12 ± 0.18 c	9.72 ± 0.28 b	2.12 ± 0.13 a	3.05 ± 0.17 c	5.03 ± 0.13 a	77.02 ± 3.4 a
	10%	5.92 ± 0.18 b	10.92 ± 0.98 ab	1.42 ± 0.08 c	3.34 ± 0.16 b	4.38 ± 0.12 a	71.08 ± 1.92 b
	20%	6.02 ± 0.28 b	11.12 ± 0.38 a	1.73 ± 0.07 b	3.53 ± 0.07 b	4.48 ± 1.1 a	72.59 ± 1.41 ab
	30%	6.42 ± 0.08 a	11.62 ± 0.88 a	1.84 ± 0.05 b	3.78 ± 0.05 a	4.92 ± 0.38 a	70.66 ± 2.34 b
L.S.D. (.05)		ª 0.364	ns1.317	' 0.165	* 0.234	ns 1.108	* 4.486

Means with the same column followed by the same letter are not significantly different at **P <** 0.05; ns = Non -significant; * = significant values; S.E. = Standard Error; Each value are mean of 4 replicate.

and 30% in pan bread the protein contents reached (15.8, 14.02, 14.12%), (11.62, 11.82, 12.02%) and (10.92, 11.12, 11.62%) respectively, however these percentages were lower than that in control which was 972%.

Concerning ash content, sweet lupin seeds protein concentrate, chickpea seeds protein concentrate added to pan bread at percentages from 10, 20 and 30% showed higher values (3.33, 3.43, 36.2%), (3.34, 3.53, 3.78%) respectively.

Fat content decreased gradually in pan bread replacement with sweet lupin seeds protein, chickpea seeds protein concentrate and common on bean seeds protein concentrate at percentages; 10, 20 and 30% as it was (3.62, 3.82, 3.94%), (3.82, 3.93, 3.99%) and (4.38, 4.48, 4.92%) respectively. While the control was of 5.03%. Total carbohydrates took the same trend as fat and decreased gradually when pan bread was replacemented at percentages 10, 20 and 30% as shown in Table (5) where they were (70.82, 72.90, 73.29%), (74.11, 72.52, 73.22%) and (71.08, 72.59, 73.66%) respectively compared to control which was of 78.82% total carbohydrates.

Also, fiber content decreased gradually in pan bread replacemented with sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds protein concentrate at 10, 20 and 30% hence it was 2.12% in control and decreased to (1.64, 1.82, 1.93%), (1.32, 1.46, 1.62%) and (1.42, 1.73 and 1.84%) respectively.

4.4.4.3. Minerals content of pan bread replaced with sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds protein concentrate:

Data presented in Table (11), illustrate content of minerals (calcium, phosphorus, iron, potassium, magnesium, manganese and sodium of sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds protein concentrate prepared from pan bread product.

Results showed that the effect of addition of 10%, 20% and 30% influenced the mineral the mineral content of product (pan bread). Such addition markedly, increased the mineral matter contents of pan bread e.g. iron, manganese, potassium, sodium and phosphorus.

4.4.4.4. Amino acids content of pan bread replacemented with sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds protein concentrate:

The amino acids composition of a food protein is of fundamental importance in determining its nutritional assessment of any food protein or its products. Chemically speaking, amino acids analysis describes a protein in terms of its content of each amino per unit mass of protein and in turn these data are useful in determining the amino sequence of such protein.

Chromatograms of the identified amino acids present in sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds protein concentrate

Table (11): Mineral composition of experimental pan bread product (mg/kg (ppm) in sweet lupin seeds concentrate, chickpea seeds protein concentrate and common bean seeds protein co[illegible] [on dry weight basis].

Minerals	Sweet lupin seeds concentral			Chickpea seeds protein concentrate			Common bean seeds protein concentrate		
	10%	Z0%	ƎO%	10%	Z0%	Ǝ0%	IO%	Z0%	30%
Calcium	13000	14000	I6000	L18000	I9000	I9800	30000	I7I000	15000
Phosphorus	IZ000	13000	14000	L11 000	I I 8000	I6000	34000	37000	Ǝ9000
	9Z ZZ	96ɔ I	98 I8	9Zɔ I	9LI*Z8	IOΓ ZO	Ǝ7IZ9	7IIOΓ	⅃Z OΓ
Potassium	I788	Z7II9	Ǝ IƎZ	ZS09	ƎS98	66517	Z6I6	Ǝ890	q898
I Magnesium	ƎtEɔO	Ǝ90 9	454.30	7I8 Ǝ0	qI9 I0	588.81 I	Ǝ66.6	7I9.Z	4536.0
I Manganese I	8Z 6I	128.40	238.41	ɔɔ	IO ZI	I6.9S	KEZ	I6.98	6S II
sodium	Ǝ607	ƎƎ8Z	7I600	NI	7I8	7I6Z	7II7I6	7IƎZ8.	Ǝ9S !

replacement in pan bread indicated the present of 17 proteinaceous amino acids (Table, 12).

The aim of analyzing amino acids was to make comparison among pan bread prepared during the course of the present study rather than comparison with other literature data. The predominant amino acids in all samples were glutamic acid followed by aspartic. However, these acidic amino acids did not represent the largest percentage of the total amino acids present the largest percentage of the total amino acids present in all samples.

Neutral amino acids (Thr, Ser, Pro, Gly, Ala, Val, Leu and lieu) comprised the minor part (33.76% in pan bread) of the control, but the other samples, sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds protein concentrate, (10%, 20% and 30%)., (34.65%, 35.37%, 35.16%), (34.49%, 35.06%, 35.62%) and (30.53%, 35.81%, 35.62%). As shown in Table (12), the basic amino acids (Lys., His. and Arg.) constituted a smaller ratio of the total amino acids. Lysine is the limiting amino acid in cereals (FAO, 1970). Among the sulfur amino acids, methionine and cystine the lower values indicted that sulfur amino acids constituted the smallest fraction in the total amino acids of the control (pan bread) and the replacemented in sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds protein concentrate percentage 10%, 20% and 30%.

The basic and acidic amino acids suffered from a decrease in their amount. Such change could be explained by the fact that these amino acids could presumably by the Millard reaction

Amino acids	Control gm/16 gm N		lupin seeds I concentrate		protein Chickpea seeds concentrate			Common bean seeds protein concentrate		
		77	Z0%	%OE	%oi	%OZ	%OC	%D	%OZ	%OC I
Lysine	OO'f	OZ'E	EVE	OS'E	OT'£	ZrE	E	LO'E	8I'E	OE'E
Methionine	OO'i	I7I'T	6S'I	OL'I	LOT	9I'T	0rt	0I T	EZ'T	I Of
Cystine	Z8'0	68'0	t760	86'0	L8 O	Z6'0	L6 O	S8 O	T6'0	96'0
Thrionine	SO5	8Z'S	8I7'g	69'g	tug	6I'g	ZE'S	9I'g	OE'S	qt7'g
aupnaiosi	I8'Z	Z6'Z	66'Z	00'E	£6 Z	96'Z	00'E	06'Z	S6'Z	66'Z
leucine	5I7I7	6SI7	89I7	SL'17	907	OLI7	Z8I7	OSI7	6SI7	Z9'I7
Phenylalanine	E9I'S	9L'S	58'g	06'S	SL'g	Z8'S	Effg	EL'S	S8'5	E6'S
Valine	£9I7	007	Z8'I7	I6I7	£LI7	08I7	Z6I7	gLI7	t78I7	06't
aulunli	81 5	6Z'S	9E'g	I47g	OE'S	TVS	ZS'S	EE'g	I7I7'S	Zg'g
Histidine	I6*Z	66'Z	00'E	TUE	96'Z	66'Z	90'E	S67	86'Z	LO'E
Serine	£9*£	I7I:£	Z8'E	06'E	9L'E	t78'E	Z6'E	LL:£	98'E	EE6'E
Glutamic acid	z5•LT	89I I	LSC LI	OS'a	09Ii	SCLI	08I I	ETLI	EtLI	08IT
Aspartic acid	zL*5	08 5	06'S	86'S	E8'S	88'g	66'S	98'5	Z6'g	L6'S
aupS19	1st	88I7	Z6I7	66't7	L8I7	06'I7	96I7	98I7	I6I7	L6I7
3111113W	'ME	88'E	E6'E	96'E	98'E	Z6'E	98'E	g8'E	g6'E	86'E
	775I7	777	7O7	07#	89I7	SLI7	Z8I7	S9I7	OO7	807

during processing of pan bread products. Literature data for sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds protein concentrate percentage (10%, 20% and 30%) included results of **Compos and El-Dash (1978), Bahnassey *et al.* (1986), Faheid and Hegazy (1991) results showed that addition of non-wheat protein materials, at these supplementation levels, caused an increase in all amino acids decreased. Lysine content (as the first limiting amino acid) of supplemented cookies also increased from chickpea flour and lupines flour at level 15% were added to cookies respectively.**

4.4.5. Common bean milk product:

4.4.5.1. Chemical composition of common bean milk:

In the traditional way of making common bean milk, presoaked Common beans are ground with a stone mill while a small stream is added. The ground mass is heated to boiling for 15-30 min. with constant stirring and additional water. The heating improves nutritive quality and flavor and pasteurizes the common bean milk. The cooked ground mass is strained through the cloth. In the laboratory or at home, an electric blender is used for grinding the beans. To insure the maximum protein recovery, a water to dry bean ratio of 5:1 is usually recommended. From 100 g of Common beans approximately LO L of common bean milk is obtained. Although any variety of common beans may be used, common beans that have large uniform size, light colored hilum, thin seed coat, and high protein are preferred for common bean milk.

Table (13): The proximate analysis of prepared common bean milk and yoghurt[on fresh weight basis].

Contents	Analysis	
	Common bean milk	Yoghurt
Protein	4.23%	5.27%
Fat	9.34%	9.62
Ash	**0.64%**	**0.89%**
B1	0.74 mg/kg	2.4 mg/kg
B2	2.3 mg/kg	2.6 mg/kg
pH	6.35	4.26
Total solids	**17.9%**	**18.38%**
Fiber	0.38%	0.42%
Lactose	4.3%	0.72%
Titratable acidity	0.48	0.64%

The results from this study in Table (13). The proximate analysis of prepared common bean milk, the total solids, fiber, fat, ash. Lactose, vitamin **B1, B2,** pH, protein and acidity, (17.9%, 0.38%, 9.34% ash 0.96%, 4.3%, B_1 0.74 mg/kg, **B2** 2.3mg/kg, pH 6.35, protein 4.23% and titratable acidity 0.48% respectively.

The nutritional value of Common bean milk is largely due to its proteins and vitamins. Common bean milk proteins are rich in lysine but limited by sulfur-containing amino acids (cystine, cysteine and methionine). Comparing the vitamin content in common bean milk, the latter has higher thiamine (B1), riboflavin (B_2), Table (9). It is known that lysine becomes unavailable due to Millard reaction between the E-amino group of lysine and reducing sugars.

Some vitamins may suffer losses due to heat treatment. The extent of thermal destruction of the nutrients depends on the time-temperature combination of the thermal process. It has been reported that during pasteurization and UHT treatment of dairy milk, protein and vitamin losses due to heating are very small. However, high temperature sterilization of milk in cans or bottles produces greater loss. The effect of thermal processing on milk has been reviewed by **Kessler (1989), Kwok and Niranjan (1995).** Common bean milk and dairy milk have similar compositions but differ in some chemical constituents. For example, common bean milk does not contain the reducing sugar lactose as in dairy milk. As reducing substances may cause damage to some amino acids through the Millard reaction, the heat stability of proteins in common bean milk and dairy milk may differ. Further, common bean milk contains antinutritional factors. It has been well established that the nutritive quality of vegetable protein is improved by heat treatment. The mechanism by which proteins are better available after treatment may result from an increased accessibility of protein to enzymic attack, and may also be due to inactivation of antinutritional factors. Heating is therefore an important process which affects the protein nutritional quality in common bean milk. Generally, the nutrition quality first increases with heat treatment due to inactivation of biologically active factors, passes through a maximum, and then decreases due to destruction of essential amino acids such as cystine and lysine. In common bean milk processing, it is necessary to have a balance between inactivation of antinutritional factors and destruction of nutrients.

4.4.6. Yoghurt product:

4.4.6.1. Chemical composition of yoghurt:

Yoghurt substitute was made from recombined containing 9.62% fat and total solids 18.38% which was added common bean milk at the percentage (300 gin) with 1150 gm buffalo milk. Titration acidity and pH value were estimated after incubation. Lactose content was determined in yoghurt, at the end of incubation period (3h) and at the end of cold. Besides, the final product was analyzed in Table (13), the results of contents protein, fat, ash, B 1, B2, pH, total solids, fiber, lactose and titratable acidity (5.27%, 9.62%, 0.89%, 2.4mg/kg, 2.6mg/kg, 4.26, 18.38%, 0.42%, 0.72% and 0.64% respectively.

The results obtained are similar **Buono *et aL* (1990), Lee *et al.* (1990). Buone *et aL* (1990)** studied the soymilk yoghurt with fortifiers, 25% fructose (soy F), evaporated milk (soy EM) or nonfat dry milk (soy N), were compared for tachyons concentration; pH; sonr, sweet and beany flavor; and viscosity. Beaniness was reduced significantly compared to unfermented soymilk; soy F had the lowest panel score. Sour flavor determined by a trained sensory panel on a 10-point intensity scale was 1.8, 7.8 and 8.0 for soy EM, and soy N, respectively. Mean sensory viscosity scores for these yoghurts were 4.8, 7.9 and 9.0, respectively. Sour flavor viscosity for soy F were significantly lower than for other yoghurts. No relationships between analytical and sensory measurements of flavor were found; however, instrumental viscosity measurements were linearly related to sensory score.

Lee ***et al.*** **(1990)** studied the milk-based yoghurt and soymilk-based yoghurt were formulated from milk, soymilk and activated carbon treated soymilk containing 3.-5% (w/w) added whey protein concentrate (WPC) or nonfat dry milk (NFDM) and fermented with commercial yoghurt bacteria culture. The activated carbon process was relatively ineffective for removing phenolic compounds and off-flavors from soymilk. WPC and NFDM both functioned well as ingredients for formulating soymilk -based yoghurt products that compared well with milk-based yoghurt in every aspect studied except for lack typical yoghurt and acidity flavors and presence of soy off-flavors.

Martinez *et al.* (2003) studied that the lupines campestris milk-like product was obtained with 6.3% protein by using alkaline thermal treatment. The color of the suspension showed a greater similarity to cow's milk than to commercial soymilk. To adjust the carbohydrate concentration and induce fermentation. 3% of sucrose and 1.5% of lactose were added. The product was pasteurized and inoculated with a culture of *Stereptococcus thermophilus* and *Lactobacillus* ssp. *bulgaricus.* A lupin yoghurt-like product with pH 4.02, 0.87% lactic acid, and a lactic acid bacteria count (3.2×10^8 CFU $m1^{-1}$) and a viscosity similar to commercial cow's milk yoghurt was obtained. The amino acid composition of the proteins in the lupin milk and yoghurt products had a good balance, with the exception, as in other legumes, of the sulfur-containing amino acids. Sensory evaluation indicated that the product was well accepted by consumers. These offer a good possibility for the utilization of this legume in human nutrition through the elaboration of products that are analogous to other already present in the commercial market.

4.5. Utilization of sweet lupin seeds proteins isolate, chickpea seeds protein isolate and common bean seeds protein isolate (P.1.):

Protein isolate prepared from sweet lupin seeds protein isolate, chickpea seeds protein isolate and common bean seeds protein isolate extracted with NaOH, then isoelectric protein precipitated with HCl acid was diluted with water at the ratio 1:2 (P.I. : water) (W/W) then used for substitution of 10, 20 and 30% of beef used in beef burgers.

4.5.1. Beef burgers as prepared with sweet lupin seeds protein isolate, chickpea seeds protein isolate and common bean seeds protein isolate (Pi.):

4.5.1.1. Proximate composition of beef burgers as influenced by the levels of (P.I.):

Results in Table (14) show the chemical composition of uncooked beef burgers prepared with (P.I.) (Table 14) contained about % protein. Due high protein content P.I. was diluted with water before use as meat replacement. Irrespective of such dilution, P.I. was able to raise some what the protein content of beef burgers (Table 14) from 16.30-25.16% (D/W). As the P.I. level increased the moisture and fat content decreased, ash and carbohydrate increased, fiber value were very slight changed. The nutritional value of burgers possibly improved with increasing of P.I. Besides, P.I. might reduce the production cost and consumer price of burgers and saving of a part of high price beef through replacement with P.I.

Proximate chemical composition of fried beef burgers as influenced by the level of P.I. is given in Table (15). From these results it seem possible that the water binding ability of P.I. was quite effective. In the uncooked burgers the moisture content decreased with increasing of P.I. level (Table 14). Heating during cooking caused the loss of moisture content which decreased from 70.25% to 64.21% for control which samples (Tables 20 and 21). But in fried burgers, as the level of P.I. increased, retained moisture also increased. In this connection fried samples with 20 and 30% P.I. contained as high as (17.83 and 17.90%);

Table (14): Proximate composition of uncooked beef burger as influenced by the levels of sweet lupin seeds protein isolate , chickpea seeds protein isolate and common bean seeds protein isolate (on fresh weight basis).

Properties	Control	Sweet lupin isolate			Chickpea isolate			Common bean isolate		
		10%	20%	30%	10%	20%	30%	10%	20%	30%
Moisture	[illegible]	17.70	[illegible]	17.90	15.20	15.16	15.13	16.50	16.62	16.73
Protein	[illegible]	34.30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fiber	3.80	5.38	[illegible]	[illegible]	[illegible]	[illegible]	1.98	[illegible]	3.30	[illegible]
Ash	2.35	4.48	4.53	4.00	3.83	3.89	3.90	3.72	3.80	3.84
Fat	4.16	5.46	5.62	5.70	6.12	6.20	6.30	5.14	5.25	5.30
Carbohydrate	3.12	31.30	30.60	30.30	48.13	47.00	46.10	48.12	46.60	45.20

Table (15): Chemical composition of cooked beef burger replacement with sweet lupin seeds protein isolate, chick-pea seeds protein isolate and common bean seeds protein isolate (on dry weight basis).

Treatment		Total chemical constituents % (Mean 1 S.D.)					
		(0 Moisture	Protein	Fiber	Ash	Fat	Carbohydrate
t lu telt	Control	64.21 ± 4.79 a	18.221 0.78 c	4.23 ± 0.17 b	2.30 ± 0.09 c	7.68 ± 0.32 b	2.62 ± 0.2 b
	10%	10.8 ± 1.1 b	38.3 ± 1.7 b	5.15 ± 0.25 a	4.87 1 0.13 a	13.48 ± 1.02 a	26.22 ± 1.78 a
	20%	10.2 ± 0.8 b	40.9 ± 2.4 ab	5.25 ± 0.15 a	4.92 ± 0.28 a	13.62 ± 1.38 a	24.33 ± 1.67 a
	30%	10.12 ± 0.93 b	43.5 ± 1.7 a	5.36 ± 0.14 a	4.10 1 0.19 b	1262 1 1.08 a	24.05 ± 1.95 a
L.S.D. O.05)		* 4.769	* 3.281	* 3.44	* 0.352	* 1.932	* 2.947
⋮ lc Ii	Control	64 21 ± 4.79 a	18.22+ 0.78 c	4.23 ± 0.17 a	2.30 ± 0.09 b	7.68 ± 0.32 b	2.62 ± 0.2 b
	10%	8.11 ± 0.89 b	31.2 ± 1.8 b	2.00 ± 0.1 c	3.96 ± 0.14 a	12.32 ± 1.18 a	34.43 1.56 a
	20%	8.23 ± 0.77 b	34.4 ± 1.6 a	2.11 ± 0.09 c	4.11 ± 0.19 a	11.00 ± 0.7 a	37.00 ± 2.00 a
	30%	8.12 ± 0.78 b	37.1 ± 1.9 a	3.10 ± 0.15 b	4.00 ± 0.2 a	3.99 ± 0.21 b	36.11 ± 1.89 ab
L.S.D. O.05)		* 4.701	* 2.98	* 0.248	* 0.303	* 1.564	* 2.989
on bean protein late	Control	64.21 1 4.79 a	18.22± 0.78 c	4.23 ± 0.17 a	2.30 ± 0.09 b	7.68 ± 0.32 b	2.62 ± 0.2 c
	10%	13.12 ± 1.38 b	28.80± 1.2 b	3.52 ± 0.18 b	4.10 ± 0.25 a	11.12 ± 0.38 a	38.17 ± 1.83 a
	20%	13.52 ± 0.48 b	32.5 ± 2.5 a	3.73 ± 0.17 b	4.28 ± 0.22 a	10.32 ± 1.18 a	35.09 ± 1.91 b
	30%	13.92 ± 1.08 b	34.10± 0.9 a	3.12 ± 0.18 c	4.12 ± 0.18 a	10.16 ± 0.74 a	34.11 ± 0.89 b
L.S.D. O.05)		* 4.823	* 2.841	* 0.330	* 0.366	* 1.398	* 4.486

Means with the same column followed by the same letter are not significantly different at $P < 0.05$; * = significant values; S.E. = Standard Error; Each value are mean of 4 replicate. (1): values were determined on fresh weight basis.

(15.16 and 15.13%); (16.62 and 16.73%) moisture, respectively, compared with samples of fried beef burgers which confirms the possible high water capacity (WHC) of the loss of moisture by flying caused (on D.W.) accordingly the increase of other components. For example, uncooked samples (Table 14) had 16.30-25.16% protein, while cooked burgers (Table 15) showed 18.22-34.10% according to the level of P.I. For fried samples with increasing of P.I., proportion the protein (and accordingly the nutritional value) increased; control and 20-30% P.I. fried burgers had 18.22 and (40.90-43..50% protein); (34.4-37.10% protein); (32.50-34.10% protein), respectively .

The fat content decreased with increasing of P.I. level.

Finally, the 20% or 30% fried burgers are less carbohydrates of food than the control samples. Therefore, 20% or 30% P.I. fried burgers may be considered as more health food.

4.5.1.2. Determination of chemical characteristics of lipid extracted from beef burger:

4.5.1.2.1. Peroxide value (P.V.):

Table (16) showed the peroxide value of meat freshly prepared beef burger treated with sweet lupin seeds protein isolate, chickpea seeds protein isolate and common bean seeds protein isolate at the percentage (10, 20 and 30%) mentioned before product of beef burger. The peroxide value resulted in 5.60 ml/kg lipids. From the above mentioned data, it could be concluded that, the cow fat showed the highest antioxidant value. The peroxide formation due to retarding the peroxide enzymes and in parallel improved the beef burger.

4.5.1.2.2. Acid value (A.V.):

Table (16) show the acid value of meat freshly prepared beef burger treated with sweet lupin seeds protein isolate, chickpea seeds protein isolate and common bean seeds protein isolate at the percentage (10, 20 and 30%) mentioned before product of beef burger. The acid value resulted in 0.30 ml/kg lipids. From the above mentioned data, it could be concluded that , the cow fat showed the highest antioxidant value. The glycerides to glycerol and free fatty acids, and consequently improved extent of beef burger.

4.5.1.3. Microbiological examination:

4.5.1.3.1. Total bacterial count:

Table (17) illustrated the total bacterial count of meat used prosing of all burger blends its low number content were from 31 x 10^3 cell/mg. while the increase in bacterial load at end of storage period may be due to increase in pH value at end of storage period, consequently support the bacterial growth or during thawing operation, which exposure the samples to bacterial growth from the environment.

4.5.1.3.2. *E. coli* and *Salmonella:*

E. coli and *Salmonella* counts of all treatments its (negative) under all processing conditions of used product the beef burgers, especially *Escherichia coli, Salmonella* spp as shown in Table (17).

Gross analysis	Cooking loss	* Water holding capacity (cm^2)	Plasticity (cm^2)	Peroxide value	Acid value
Fresh meat cow	38.12 %	2.23 cm^2	2.55 cm^2	5.60 ml/kg	0.30 ml/kg

4.5.1.4. <u>Determination of beef burger freshness:</u>

4.5.1.4.1. <u>Cooking loss:</u>

Table (16) show the cooking loss of meat freshly prepared beef burger 38.12%. The obtained data were agreement with the finding of **Hala *et al.* (1999).**

4.5.1.4.2. <u>Water holding capacity (WHC) and plasticity:</u>

Table (16) show the water holding capacity WHC and plasticity of meat freshly prepared beef burger of 2.23 cm^2, concerning plasticity of beef burger showed plasticity of 2.55 cm^2.

4.5.1.4.3. <u>Coking yield, cooking loss and shrinkage:</u>

Te results of Table (18) show the cooking yield, cooking loss and shrinkage of fried beef burgers as influenced by the level of P.I. yield was higher while losses and shrinkage lower as the percent of P.I. increased. Such a result was confirmed by the progressive increase of retained moisture in fried sample (Table 15).

4.5.1.5. <u>Amino acid composition of fried burgers influenced by the level of P.I.:</u>

Amino acid composition of beef burgers protein as influenced by the level of P.I. is given in Table (19). From these results, it could be observed that the 16 amino acids present in different formulations all mixing and that of control, sweet lupin seeds protein isolate, chickpea seeds protein isolate and common bean seeds protein isolate at the 10, 20 and 30% from added into beef burgers were determined as g/100 gram sample. It could be noticed that control, (10% sweet lupin seeds protein isolate, 10%

Table (18): Cooking loss, cooking yield and shrinkage of beef burgers as influenced by the level of sweet lupin seeds protein isolate, chickpea seeds protein isolate and common bean seeds protein isolate [on dry weight basis].

IN j3&4	Co IIro	Samples (level of protein isolate)								
			weet lupi Dteinisol		Chickpea protein isolate			Common bean protein isolate		
		1//	Z0%	30%	I0%	Z0%	Ɛ0%	I0%	Z0%	Ɛ0%
Cooking loss %	ZZ.IO	ZI.I6	SUL,'	I6.ƎO	I8 II		I6ɹO	I9 ƎZ	I8.OZ	
Vi¿ld %	⅂8.ƎZ	⅂9.80	8I ZƎ	SƐ.00	8Z IZ	8Ɛ.6Z	I7I.58	80.I5	8Z ƎZ	II178
Shrinkage		I9	I⅂	ZO	00	V)	S!	ON	O	I7I

Table (19): Amino acid composition of fried beef burgers (gm/100gm sample) as influenced by the level of sweet lupin seeds protein isolate, chickpea seeds protein isolate and common bean seeds protein isolate [on dry weight basis].

Amino acids composition	Ocin.ro	Sweet lup protein isol			Chickpea protein isolate			Common b rotein isol		
		I0%	Z0%	30%	I0%	Z0%	30%	I0%	Z0%	30%
Aspartic acid	10.36	10.10	10.MS	10.00		11.1Z	11.06	10ΛZ	10.06	10.0Z
Methionine	Z	1*98	1.93	1.9	S171I	1.38	1.30	1746	9.Z0	9.19
Thrionine		SCE	SCE	3 30	SVC			1.66	1.60	1.S8
Serine	1703	10*3	3.00	3 01	3.88	3.8Z	3.80	3 IS	3.1 1	3 09
Glutamic acid	Z3.16	Z3.08	Z3.0Z		Z0F3	Z0 071	Z0 01	18.66	18.6Z	18.60
Proline	S.00	4198	S.96	S.93	4108	41.06	41 071	41E71	4130	41Z9
Glycine	S.SZ	S.Z0	S.18	S.IS	4116	4113	4110	41Z3	Ott	41.19
Alanine	1763	ZWE	3C8	3		S.00	TOT	717	S.IS	77

Table (19) continue: Amino acid composition of fried beef burgers (gm/100gm sample) as influenced by the level of sweet lupin seeds protein isolate, chickpea seeds protein isolate and common bean seeds protein isolate [on dry weight basis].

Amino acids composition	Cont r	Sweet lui rotein isa			Chickpea rotein isolate			I_ Common bean protein isolate		
		[illegible]	[illegible]		I00/o	Z0%	Ɉ0%	ɈO%	ZO%	Ɉo%
Cysteine	6477	0E7	8Z7	SZ'	1 S9	SC	S6'	1'8S	180	6L'1
Valine	S'0E	S'00		S'00	8E17	SE't	ZE't	9I't	II't	6047
isoleucine	II 'S'	S'00	8617	96't	6t£	9r£	EZ'£	IL't	S9't	19'17
Leucine	EZ'6	9.08	170'6	10'6	89'11	0911	85'11	6I'8	Er 8	8.09
Phenyl alanine	[illegible]	6017	SO't		9Z'S	6I'S	[illegible]	LI 'S	zi.,	[illegible]
Histidine	S.60	S.S0	817'S	9Z:S	£617	9817	Z8'7	t7I'S	60'S	[illegible]
Lysine	6.68	6.60	6*SS	6*SE	017'L	EE'L	0E'L	-I0'l	00'L	[illegible]
Argnine				6*SO I	6 Zt7	6.£S		6.I6	6. IZ	[illegible]

chickpea seeds protein isolate and 10% common bean seeds protein isolate) contain of higher contents of all amino acids that that in 20%, 30% sweet lupin seeds protein isolate, chickpea seeds protein isolate and common bean seeds protein isolate .

On the other hand the control had higher percentages of every amino acids than present in all formulation containing protein isolate in three legumes (sweet lupine, chickpea and common bean). However, methionine and cysteine were in lowest amount in comparison to other amino acids.

These results similar with those obtained by **El-Aswed** *et* **(1980) and Eisha** ***et aL*** **(2000).**

4.5.1.6. Organoleptic evaluation and texture indices of fried beef burgers:

Data presented in Table (20) show the sensory evaluation results of fried beef burgers and calculated texture indices of raw and fried samples as affected by the level of P.I. It could be observed that the color of fried beef burgers was not influenced by the addition of P.I. at any level up to 30%.

Aroma, taste and overall acceptability were the same to 20%. At 20% P.I., however slight decrease in texture occurred. The decrease in texture occurred score by addition of P.I was confirmed by increase of PWC and PEFC. But this decrease (sample given 8.8 score) is of no importance, because according to judging scale highest texture quality (very good) is given 9.3 score. Similarly, scores given for aroma, taste and overall acceptability (8.7 scores) for fried burgers with 30% P.I. although less than for the control sample (9 scores) means no decrease in quality grade.

Table (20): Organoleptic evaluation (average score) and texture indices of beef burgers as influenced by the level of sweet lupin seeds protein isolate, chickpea seeds protein isolate and

Samples				cteristic!			Texture indices			
		Aroma	Taste	Color	Texture	Overall acceptabilit	M		Fried	
		10	10	07	10	10	DMd I	dMd D	DAAd	[illegible]
Contr		1 7 7-6	8	8 8 6	n 9.6	9.S	0.7187	77=	0.7230	0.16LL
Chickpe a	10%	E 0.6	8.8	qu C*6	8•8	9.0	0.Z86Z	7.73 47	0.7Z60	0.71866
	20%	oci L'L		ε L'L	o 8.9	S'L p	0.3OI	SC 00I	ZOICO	I 0.5048
	1767	1707	777	a g•17	P O•S	S.S	O ZIE0	0.Z66LI	O 690Z	0.5322
Sweet lupine	10%	n Z*6	n 0.6	B 0.6	clg 8.8	9.0 qu				-
	20%	qu L*8	z'a	ε L'L	oct	8.0 ε				-
	30%	6L ΦL+	37	0-L L	pC'S	6.0 ε				-
Common bean	10%	Z'6	e8.8	CP0•6	qg0.6	[illegible]				-
	20%	qu Z'8	9.0	°(1 S 8	oq £.8	g'8 3†				-
	30%	77.		0	o EI	SL p				-
					ao't	18.0				

The texture of 30% all samples studied P.I. fried burgers (7 scores; good) was less than for the control and 10-20% P.I. of all samples under studied (8.2-9.3 scores ; very good).

The results of organoleptic scores (Table 20) indicated that it is enough to replace 20% of beef with equal proportion of diluted P.I. to obtain burgers with maximum good quality (very good grade).

Nevertheless, burgers with 30% P.I. may be also produced comically as burgers of such treatment showed good quality grade.

4.6. <u>Biological values of pan bread and beef burger product from protein concentrate and protein</u> isolate:

Table (21) showed that the results of control pan bread of true digestibility (T.D.), biological value (B.V.) and net protein utilization (N.P.U.) with sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds protein concentrate (10, 20 and 30%), is results of control lower than that the other results. Means within the same column with the same letter are not significantly different. The results of B.V. and N.P.U. simaller true digestibility, the addition sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds protein concentrate had improved the T.D, B.V and N.P.U. in percentage (10, 20 and 30%).

The results of pan bread product in chickpea with control and other percentage adding from chickpea seeds protein concentrate (10, 20 and 30%), its means within the same column

Table (21): Effect of pan bread and beef burger replacement with sweet lupin seeds protein isolate, chick-pea seeds protein isolate and common bean seeds protein isolate on T.D, B.V and N.P.U. [on fresh weight basis].

Treatment		Pan bread (Mean ± S.D.)			Beef burger (Mean ± S.D.)		
		TD	BV	NPU	TD	BV	NPU
ịpị ;	Control	65.80 ± 0.18 d	42.40 ± 0.27 d	27.90 ± 0.09 d	90.30 ± 0.45 a	78.40 ± 0.18 a	70.80 ± 0.81 a
	10%	67.82 ± 0.08 c	47.82 ± 0.08 c	32.25 ± 0.33 c	86.37 ± 0.08 c	75.57 ± 0.05 b	65.30 ± 0.31 b
	20%	70.65 ± 0.19 b	47.65 ± 0.19 b	33.67 ± 0.1 b	86.47 ± 0.8 c	74.15 ± 0.08 c	64.08 ± 0.12 c
	30%	71.42 ± 0.08 a	71.42 ± 0.08 a	33.02 ± 0.15 a	86.87 ± 0.05 a	72.57 ± 0.05 d	63.02 ± 0.08 d
L.S.D. gur)		* 0.169	* 0.207	0.231	* 0.280	* 0.127	* 0.526
peg ;	Control	65.80 ± 0.18 d	42.40 ± 0.27 d	27.90 ± 0.09 d	90.30 ± 0.45 a	78.40 ± 0.18 a	70.80 ± 0.81 a
	10%	66.77 ± 0.14 c	44.52 ± 0.29 c	24.72 1 0.24 c	84.22 ± 0.17 b	73.57 ± 0.05 b	61.93 ± 0.15 b
	20%	71.40 ± 0.26 a	46.35 ± 0.88 a	32.68 ± 0.18 a	84.22 ± 0.39 b	72.1 ± 0.09 c	60.58 ± 0.08 c
	30%	70.30 ± 0.18 b	45.43 ± 0.16 b	31.92 ± 0.12 b	84.07 ± 0.08 b	70.37 ± 0.12 d	59.17 ± 0.1 d
L.S.D. mos)		* 0.234	* 0.589	* 0.202	* 0.374	* 0.144	* 0.499
bean isob	Cont"	65·80 ± **0.18** d	42.40 1 0.27 d	27.90 ± 0.09 c	90.30 ± 0.45 a	78.40 ± 0.18 a	70.80 ± 0.81 a
	10%	67.90 ± 0.21 c	44.13 ± 0.12 c	29.92 ± 0.08 b	85.68 ± 0.08 b	73.52 ± 0.15 b	63.00 ± 0.13 b
	20%	71.80 ± 0.09 a	45.82 ± 0.59 a	32.88 ± 0.42 a	85.62 ± 0.08 b	71.33 ± 0.1 c	61.05 ± 0.14 c
	30%	70.95 ± 0.27 b	45.82 ± 0.34 b	32.93 ± 0.28 a	84.20 ± 0.14 c	70.33 ± 0.11 d	59.22 ± 0.1 d
L.S.D. 016)		* 0.240	* 0.446	* 0.284	* 0.290	* 0.165	* 0.501

Means with the same column followed by the same letter are not significantly different at **P** < 0.05; * = significant values; S.E. = Standard Error; Each value are mean of 6 replicate.

with the same letter are not significantly different at ($p < 0.05$) of the results obtained. Two the results of pan bread product in common bean seeds protein concentrate (10, 20 and 30%) at the similar pan bread product from sweet lupin seeds protein concentrate and chickpea seeds protein concentrate (10, 20 and 30%) its means within the same column with the same letter are not significantly different ($p < 0.05$). The determination of true digestibility (T.D), Biological value (B.V) and Net protein utilization (NPU) by means of rats did not using caseine from all the experiments on rats.

From the obtained results in Table (21 and 22) of pan bread observation sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common bean seeds protein concentrate, T.D, B.V and N.P.U. were lower than that the results of beef burger with adding sweet lupin seeds protein isolate, chickpea seeds protein isolate and common bean seeds protein isolate (10, 20 and 30%). Because the wheat flour is deficient the Lysine and the three legumes used of product pan bread of deficient of methionen, cystein and isolucine two the amino acids lysine, methionen, cystein and isolucine in essential amino acids. Therefore the results of pan bread decreased in the true digestibility, biological value and net protein utilization.

The results of control beef burger of true digestibility, biological value and net protein utilization with sweet lupin seeds protein isolate, chickpea seeds protein isolate and common bean seeds protein (10%, 20% and 30%) this values were not markedly changed with at all adding of 10% sweet lupin seeds protein isolate, 10% chickpea seeds protein isolate 10% common

Essential Amino acids	[illegible]	eet lupin			Chickpea p. c.			Common bean p. c.			
		10%	20%	[illegible]	10%	20%	30%	10%	20%	30%	Amino acid mg/g p.
Isoleucine	28.1	29.2	29.9	30.0	29.3	[illegible]	30.0	[illegible]	29.5	29.9	[illegible]
Leucine	44.5	45.9	46.8	47.5	45.6	47.0	48.2	45.0	45.9	46.2	70.04
Lysine	30.0	32.0	34.3	35.0	31.0	32.2	34.0	30.7	31.8	33.0	54.40
Methionine + Cystine	18.2	20.3	25.3	26.8	29.4	20.8	21.7	19.5	21.4	23.6	35.20
Phyenylalanine	65.3	57.6	58.5	59.0	57.5	58.2	59.3	57.3	58.5	59.3	[illegible]
Threonine	50.8	52.8	54.8	56.9	51.1	51.9	53.2	51.6	53.0	54.5	40.00
Valine	[illegible]	47.0	48.2	49.1	47.3	4.80	49.2	47.5	**48.4**	49.0	49.00
First limiting amino acid	Cystein	Cystein	Cystein	Cystein	Cystein	Cystein	Cystein	Cystein	Cystein	Cystein	Cystein
Second liming amino acid	Methio.	Methio.	Methio.	Methio.	Methio.	Methio.	Methio.	Methio.	Methio.	Methio.	Methionine
Third limiting amino acid	[illegible]	IsoLuc,	Isoluc.	Isoluc.	Isoluc.		Isoluc.		Isoluc.	Isoluc.	Isolucine

bean seeds protein isolate. However slight decreased in the true digestibility with in rang 4-6% occurred for the 20%, 30%, in all the experimental, sweet lupin seeds protein isolate, chickpea seeds protein and common been seeds protein isolate with adding into beef burger product. Sam trend occurred for biological value, the net protein utilization ranged from (62.2, 64.2 and 63.1 %), (62.0, 60.6 and 59.2 %) and (63.2, 61.1 and 592 %).

The all results obtained of means within the same column with the same letter are not significantly different at $p < 0.05$.

In order to determine the order of limiting amino acid, scores were worked out taking in account the suggested pattern of **FAO / WHO (1971)** as a base for calculation (Table, 22). Cysteine was first limiting in all samples, methionine is second limiting amino acid and isoleucine of third limiting amino acid in control of pan bread product and other product of sweet lupin seeds protein concentrate, chickpea seeds protein concentrate and common beans seeds protein concentrate replacement (10%, 20% and 30%), respectively.