Biochemical studies on some legume seeds

George Abeid Abd El-Malak

This study was carried out to analyze some different selected legumes to their macro and micronutreints and to follow up changes that could be undertaken in their constituents during different processing technique.Also the changes in some antinutritional factors (tannins, phytic, trypsin inhibitors and oligosaccharides) in some legumes subjected to soaking, germination, microwave, extrusion and irradiation were studied.An in-vivo study using albino rats fed on different blends containing different legume seeds subjected to different processing technique to obtain a well balanced protein diet beside other blends were prepared for lactating women and other to be used as weaning food.The legume seeds which were used in this study were faba bean Giza 427, chick pea Giza 2, fenugreek seeds Giza 30 and cow pea Giza 331. Both of them were subjected to different treatments including soaking for 12 hrs, germination for 4 days, microwave for 2,4 and 6 min. using two level moisture content (30 and 50%), extrusion cooking 148°C and moisture 25%, and radiation at different dose level (1,2.5,5 and 10 KGy).Raw and processed legumes were analyzed for their main constituets and mineral contents. The changes in the major component (protein, fat, carbohydrate, crude fibre and ash) and minor component (minerals) due to processing were summarized in tables 32,33,34 and 35.Summary and Conclusion-106-Sugars contentAshCrude fibreTotal lipidsProteinMoistureDifferent processesNon reducing-ReducingTotalavailableiydrates-3.390.774.1661.922.815.731.4127.138.5A2.550.943.4962.313.566.111.2926.739.91Soaking 12 hrs1.31.542.8462.283.797.230.9825.528.81Germination 72 hrs2.160.953.1163.133.856.911.3424.229.2moistureExtrusion 148°C 25%2.320.953.2763.923.896.040.9125.249.71moistureMicrowave 6 min. 50%2.860.723.5861.543.866.821.3526.339.53Irradiation 10 KGv-107-’1.9,1 01 uopommidi19.6ZZ-ZZIt7tt7Z’ £6E.E17L’ 99LE’ I96.Z 1Microwave 6 min. 50% moisture00’8ZYZZZI•178F£9£’£Z8’99OCEEY 1Extrusion 148°C 25% moisture19’LZ-17.1ZZ I ’E80’E17E•Et70.96ZL.17 LZI 0-ZGermination 72 hrs 0E.6 L8’1Z 9L’E L’E LYE907,9 E I .£ 8S.1Soaking 12 hrs Z.6 £t’ZZ 60t 8t7’£ 61’E18’99 LZ.17 8Z.Z 66’1 OE’9 ECEZ,--- I L’t S6’Z j7j’£L 1 *C9 L1717 611 8Z’£Different processesComponentsMoistureProteinTotal lipidsCrude fibre usyTotal availablecarbohydrates-1U)0Iu!.3np311Non reducing-lualuo3 sAurts- I 0Sugars contentTotal available carbohydrates”AshCrude fibreTotal lipidsProteinMoistureDifferent processes ComponentsNon reducing’ReducingTotal1.970.122.0950.113.647.839.3329.097.1A1.420.181.651.262.788.189.0528.739.57Soaking 12 hrs4.472.847.1147.883.9410.237.4130.5410.41Germination 72 hrs1.560.932.4952.423.848.368.0227.367.32Extrusion 148°C25% moisture1.690.882.5753.863.598.66.5327.428.91Microwave 6 min. 50% moisture1.380.461.8451.513.618.188.428.38.56Irradiation 10 KGyTable (35) : Proximate analysis of raw and processed cow pea Giza 331 (g. 100g-1 *).Irradiation 10 KGr61.6L117Z9919Z.£88’E£ ’L989’17LL*016Microwave 6 min.50% moisture6Z*86171ZS’ E68’E£6’L99EL9. I69.Z —1Extrusion 148°C25% moisturet76’L6I’EZ17 I IE17’EI L’ E£8.L9117’t7161 _1OC’ZGermination 72 hrs L0.6 6Z’ EZ 17Z’ ILZ.17 8Z.-17Z6’99£l’£ -170’Z60’ ISoaking 12 hrs 85’6 £8.EZ 691 68’E 171’E£97.9 SZ*17 6L’O917 £tsaG 09’L LUSZ 06’ I t7E’E EWE9L’59 zcs EL()66’17Different processesComponentsMoistureProteinTotal lipidsCrude fibreilsVTotal availablecarbohydrates**TotalReducingNon reducing.’wawoo saunsMoreover, raw and processed legumes were also analyzed for their different antinutritional factors such as tannins, phytic, trypsin

inhibitors and oligasaccharides content.The results can be summarized as follows :1-The changes in tannins content due to different treatments, were as follows : soaking caused decrease in tannins content amounted to 18.98, 23.71, 18.88 and 22.11% for faba bean, chick pea, fenugreek and cow pea respectively. Reverse trend was observed for germination process since tannin content gradually increased started directly after 24 hrs and continued in all germinated legumes till 72 hrs after which the amount of tannins started to decrease except for fenugreek.Also microwave (for 6 min. and at 30% moisture) caused the highest percent decrease in tannin content which was 25.84, 23.40, 18.24 and 16.10% for faba bean, chick pea, fenugreek and cow pea respectively. While the corresponding values for extrusion cooking were 20.62, 17.21, 11.91 and32.33%.On the other hand changes in tannins content in legumes subjected to irradiation at different dose level were meagre.2-Phytic acid content amounted to 550.33, 353.2, 297.34 and 220.13 mg.100g-1 in raw faba bean, chick pea, fenugreek and cow pea respectively.The percent of phytic acid destruction ranged from 13.43 to 38.37 from 7.91 to 37.74, from 6.63 to 37.1 and from 11.2 to 56.99% after soaking for 12 hrs and germination for 96 hrs for faba bean, chick pea, fenugreek and cow pea respectively. The highest destructive percent of phytic acid was in legumes treatedwith microwave at 30% moisture for 6 min. These destructive percentage were 42.54, 31.05, and 21.87% for fenugreek, faba bean and cow pea except chick pea since highest destructive percent was obtained at 50% moisture for 6 min. which reached 24.86%.The extrusion process was able to reduce the percent of phytic acid by 22.09, 14.36, 21.83 and 10.23% for faba bean, chick pea, fenugreek and cow pea respectively. The destructive percent of phytic acid at the highest dose level of gamma radiation (10 KGy) was 17.32, 10.5, 8.21 and 9.33% for faba bean, chick pea, fenugreek and cow pea respectively.3-The trypsin inhibitors in raw materials were 360.65, 1024.54, 783.46 and 678.34 mg.100g-1 for faba bean, chick pea, fenugreek and cow pea respectively.The maximum and minimum destructive percentages of antitrypsin due to different treatment could be arranged in descending order as follows : extruder (91.22 for chick pea to 94.99 for cow pea); microwave 6 min. 50% moisture (73.55 for fenugreek to 82.34 for cow pea); germination at 96 hrs (46.53 for fenugreek to 77.72 for cow pea); irradiation at dose level 10 KGy (19.04 for chick pea to 28.31 for fenugreek) and soaking (5.61 for faba bean to 11.04% for chick pea).4-The oligosaccharides raffinose and stachyose percentages were 1.27, 1.14; 1.22, 1.09; 0.43, 0.39 and 2.33, 1.94% in faba bean, chick pea, fenugreek and cow pea, respectively.Soaking reduced oligosaccharides (raffinose plus stachyose) from 24.22 for cow pea to 43.9% for fenugreek while in case of germination the reduction was 74.39% for fenugreek to 91.85% for cow pea. Other processing technique such as microwave was able to reduce oligosaccharides in moistent legumes at the level of 50% to 52.28, 42.86, 51.22 and 54.92% for faba bean, chick pea, fenugreek and cow pea, respectively.In case of extruder processing the reduction of oligosaccharides in different treated legumes ranged from 51.95% for chick pea to 64.27% for cow pea. whereas radiation (10 KGy) reduced oligosaccharides to 18.67, 22.94, 23.17 and 21.34 for above mentioned legumes.5- Different blends were prepared from different raw and processed legumes at proportion of chick pea 50%, cow pea 20%, faba bean 20% and fenugreek 10%. This proportion give a well balance amino acid according to (FAO/WHO 1990). Also, other blends were prepared to cover the need of lactating women which contained the same abovementioned blends treated with microwave with the addition of methionine 0.3% and polyethylene glycol 4000 1%. Other blend was also prepared to be used as weaning food which contained microwaved treated legumes 50% chick pea, 20% cow pea 5% fenugreek and 25% non fat dry milk (NFDM). The blends plus casein were fed to (9) groups each group contained (6) albino rats with average weight of 40-50 gm each. The feeding process extended to 12 days.The results revealed that the highest daily food intake by rats was 11.08 g/rat/day for microwave treated legume seeds followed by extruded blend legume seeds (10.06 g/rat/day).In all biological experiments increasing in weight was almost parallel with food intake except for microwave, methionine and polyethyleneglycol and microwave, rice and NFDM which gave higher weight gain for less fed rate which may be attributed to enhancement in protein digestibility.Also, the transformation index (TI) showed that both of the previous blends gave the lowest value of TI which indicate high transformed food efficiency.Protein efficiency ratio values of different blends were calculated and can be arranged in a descending order as follows : 2.91, 2.67, 2.45, 2.18, 2.16, 1.85, 1.77 and 1.53 for

microwave, blend supplemented by NFDM and modified protein by rice flour, microwave blend supplemented with 0.3% methionine and 1% PEG, microwave, extruder, germination, raw soaking and radiation, respectively.Also organoleptic aspects for different blends including color, flavour, texture and over all acceptability were given scores by different panalists. The highest scores was given to blend number (9) which suggested for weaning children followed by blend number (8) for lactating women. Other blends were moderately scored except for irradiated legumes which was given the lowest score.