Studies on removal of toxic gossypol prom cottonseed meal

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The following lines summerize the various topicswhioh were handled in the present investigation with thepurpose of finding the best procedures which could beemployed to remove the toxicity of gossypol of Egyptiancottonseed meal. The method of presentation of thissummary follows to a great extent the line of approachused in the presentation of the various topics dealtwith in this dissertation.I. Preparation of gossypol and gossypol derivatives :The extraction of pure gossypol was accomplished bytwo different methods i.e. glacial acetic acid and aniline.The yield of gossypol by precipitation with aniline wassatisfactory from extracts of cottonseed with largeamount and high purity. The obtained yellow crystallsof gossypol-acetic acid from dianilinogossypol wasexamined for its purity by determining the melting point;elementary analysis; ultraviolet and infrared spectroscopicanalysis by comparison with authentic sample and theresults were identical.II. Preparation of gossypol-lysine and gossypol-ferrouscomplexes.Gossypol-lysine and gossypol-ferrous complexes wereprepared. The ultraviolet and infrared spectroscopicmeasurements of the resulted complexes were run out, tostudy the nature of the che~cal reaction and elucidatedthe properties of the resulted materialsThe infrared spectrum of gossypol-lysine complexshowed that the absorption band characterizing the) c=ogroup was shifted to longer wavenumber, and the presenceof the strong two bands characterizingoC-amino acids at1560 cm-l and 1590 cm-l• Such results might give an additionalevidence that the reaction of gossypol throughcarbonyl groups took place with the amino group at the(-position of lysine forming Schiff f s base type.The infrared spectrum of gossypol-ferrous complexshowed that ferrous ion has much greater preference toform coordinate bands with the vicinal hydroxy groupS ofgossypol at 6,7,b,7 positions forming a stable fivememberedring.III. Determination of gossypol, protein>and amino acidsin cottonseed meal.Analysis of the investigated crude cottonseedmeal contained 0.3% free gossypol, 1.49% total gossypol,1.34% available lysine, 41.56% total protein and68.6% nitrogen solubility. Thus, it can be safelystated that cottonseed meal is a good source of protein,but toxic gossypol percent lies within the toxic valueand limits its use as a protein source for non-ruminants.IV. Effect of heating periods, moisture, metalic ions(Fe++ and Ca++) on gossypo1,protein and amino acidsin CSM.Several attempts were tried to detoxify the cottonseedmeal by different heating periods in the presenceof 8% and 15% moisture with or without ferrous and calciumions. These samples included:-CSM (8% moisture); CSM (15% moisture);CSM (8% moisture) in the presence of 1% PeSo4;CSM (15% moisture) in the presence of 1% FeSo4 andCSM (8% moisture) in the presence of 5% Ca(OH)2.0 All samples were heated at 120 C for 15,30,45,60 and90 minutes.Considering the effect of such treatments, notonly on gossypol contents, but also on the availablelysine, the solubility of the meal protein and aminoacids content. The different values obta~ed for bothfree and total gossypol showed gradual decrease duringexperimental periods, besides the essential amino acidscontent were slightly affected.It is ~portant to point out that, although theamount of free and total gossypol decreased with increasingthe heating periods, but the samples heated for 60and 90 minutes turned to dark-brown color.Heating of cottonseed meal (8% moisture) in thepresence of 1%FeS04 for 45 minutes, caused 70% and18.9% reduction in free and total gossypol respectively.The decrease in the available lysine reached to about11% , while nitrogen solubility amounted to 39.6%.Heating of cottonseed meal (8% moisture) in thepresence of 5% Ca(OH)2 for 45 minutes, caused 67.3%

and23% reduction in free and total gossypol respectively.The reduction in available lysine reached to 11.9%,while nitrogen solubility amounted to 39.77. The twoformentioned samples were used in biological evaluation.v. Biological evaluation of untreated and treated cottonseedmeals.Cottonseed meal (8% moisture content) heated onlyfor 45 minutes in the presence of 1% FeSo4 and / or 5%Ch(OH)2 were used in the biological evaluation experi-menta. Beside the two treated samples, UCSM, soybeanand casein were used as control experiments.The two investigated meals,beside UCSM without orwith soybean flour were used as the source of proteinin formulating twelve diets, which were fed to growingalbino rats. Weight gain, blood haemoglobin, totalprotein in serum and serum glutamate pyruvate transaminase(S.GPT) were measured to evaluate the diets.Vfuen untreated cottonseed meal was used as thesole source of protein, it caused lowest increase inbody weight comparing with other groups, beside therate of mortality was relatively high. Also, a noticeabledecrease in haemoglobin, serum total protein andthe S.GPT level was highly increased. Addition ofsoybean flour to the meal of cottonseed with di~ferentratios resulted in a relative increase in body weight andthe rate of mortality gradually decreased.When cottonseed meal treated with 1% FeSo4 and /or 5% Ca(OH)2 were mixed with soybean flour with differentratios to provide 10% total protein, animals ofthese meals gained much in weight than those fed on soybeanflour alone. In addition, no morta1ity cases wererecorded throughout the course of eXper~ent in groupsrecieved cottonseed meal treated with ferrous orcalcium ions. The effect of feeding diets containingtreated cottonseed meals showed a reasonable andencouraging results in haemoglobin, total protein inserum and S.GPT enzyme.