

Fatty Acid Analysis of Valencia Peanut Core Collection

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In terms of fatty acids present, peanuts (raw kernels), have 8.2g saturated fatty acids, 25.2g monounsaturated fatty acids (oleic acid) and 14.3 g polyunsaturated fatty acids per 100 g of peanuts served. Peanut oil has 18.8g of saturated fatty acids, 69.7g of monounsaturated fatty acids and 11.2 g of polyunsaturated fatty acids. The presence of high mono and poly unsaturated the fatty acids, reduces the risk of coronary heart diseases.

The present study was carried out on Valencia group of peanuts, where in 114 different genotypes of Valencia category of peanuts were received and it was proposed to determine the fatty acid profiles of these varieties.

Fatty acid methyl ester analysis was performed on an Agilent gas chromatograph equipped with a flame ionization detector and a fused silica capillary (100 m _ 0.25 mm) column with biscyanopropyl polysiloxane as the stationary phase (SP-2340), Supelco, The carrier gas was nitrogen at 12 cm/s, and the column was programmed to heat from 145 to 220° at 4 °C/ min with an initial hold time of 4 min. After 35- min hold at 220 °C, the temperature was increased to 240 °C at 4 °C/min and held for 10 min. The injector and detector were set at 250 °C. The injector was split with a split flow of 24.8 mL/min. Amino levulinic acid and Fatty acid methyl esters (FAME) were used as standards. The peaks obtained in the chromatogram were compared against the standards to identify the fatty acid composition of the samples.

The results indicated that all the varieties contained high quantities of Oleic acid (C 18:1 Monounsaturated fatty acid), followed by Linoleic acid. (C18:2, polyunsaturated fatty acid containing two double bonds), followed by palmitic acid (C 16 Saturated fatty acid) and very minute quantities of Stearic acid (C18:0 saturated fatty acid).

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Peanut is a legume crop that belongs to the family of Fabaceae, genus *Arachis* and botanically named as *Arachis hypogaea*. Peanuts are considered as a vital source of nutrients. Peanuts are rich in calories and contain many nutrients, minerals, antioxidants and vitamins that are essential for optimum health.

In terms of fatty acids present, peanuts (raw kernels), have 8.2g saturated fatty acids, 25.2g monounsaturated fatty acids (oleic acid) and 14.3 g polyunsaturated fatty acids per 100 g of peanuts served. Peanut oil has 18.8g of saturated fatty acids, 69.7g of monounsaturated fatty acids and 11.2 g of polyunsaturated fatty acids. The presence of high mono and poly unsaturated the fatty acids, reduces the risk of coronary heart diseases.

The present study was carried out on Valencia group of peanuts, where in 114 different genotypes of Valencia category of peanuts were received and it was proposed to determine the fatty acid profiles of these varieties. Techniques such as one dimensional two dimensional gas chromatography were carried out using Agilent Gas chromatographic system for one dimension and two dimensional GC using SPD Column.

The received samples were kept under frozen conditions and individually each sample numbered 1-114 were picked up and were ground into fine powder using Soxtec 2050.

Five samples of powdered Valencia peanuts were picked every time to be converted into oil. The five thimbles were numbered according to the number of the sample to be introduced. These cellulose thimbles were hooked to metal caps and their weight was tared, before introducing 1 gm of sample into each thimble. Five metal thimbles

for holding the cellulose thimbles were picked up after drying them in an oven for 15 to 20 minutes.

The cellulose thimbles were then placed into the Soxtec instrument and hooked to magnetic circles in the instrument. The instrument was operated using a control unit. The thimbles were pulled up, and the metal thimbles were inserted into the groove on the extraction unit. Into each cellulose thimble containing the powdered sample, 50 ml of petroleum ether was added as extraction solvent. The metal thimbles along with the cellulose thimbles were then lowered on to the heating plate and then the process for extraction is started.

The extraction process is divided into 3 cycles, the first cycle is for 40 minutes called the heating cycle, the second cycle is for another 40 minutes, called the extraction cycle and the third cycle is for ten minutes, which is the cooling phase. At the end of these cycles the metal thimbles containing the oil is removed and weighed. Prior to weighing the thimbles with oil are kept in an oven, to remove any excess solvent during extraction.

The extracted oil samples were further processed for carrying out chromatographic analysis for finding out the fatty acid composition.

About 0.5 g of oil was accurately weighed into a GC vial and 0.5 ml of BF_3 methanol solution was added to it. The resulting mixture was heated at a temperature of 60°C for 15 minutes with occasional shaking on a sonicator; the resulting sample is then treated with Cyclohexane, to separate the components of the mixture into two distinct phases. The upper phase is collected which contains the biological material and is then introduced into the GC for further analysis and composition.

Fatty acid methyl ester analysis was performed on an Agilent gas chromatograph equipped with a flame ionization detector and a fused silica capillary (100 m \times 0.25 mm) column with biscyanopropyl polysiloxane as the stationary phase (SP-2340), Supelco, The carrier gas was nitrogen at 12 cm/s, and the column was programmed to heat from 145 to 220° at $4^\circ\text{C}/\text{min}$ with an initial hold time of 4 min. After 35- min hold at 220°C , the temperature was increased to 240°C at $4^\circ\text{C}/\text{min}$ and held for 10

min. The injector and detector were set at 250 °C. The injector was split with a split flow of 24.8 mL/min. Amino levulinic acid and Fatty acid methyl esters (FAME) were used as standards. The peaks obtained in the chromatogram were compared against the standards to identify the fatty acid composition of the samples.

| Sample | Palmitic acid | Stearic acid | Oleic acid | Linoleic acid |
|--------|---------------|--------------|-------------|---------------|
| 3 | 16.59737005 | 3.922868947 | 56.16351072 | 23.31625028 |
| 3 | 16.8425846 | 4.0326501 | 55.68475805 | 23.44000725 |
| 4 | 16.92866162 | 0 | 44.64367285 | 38.42766553 |
| 4 | 18.07847261 | 0 | 42.01759576 | 39.90393163 |
| 5 | 22.02329671 | 0 | 40.61758357 | 37.35911971 |
| 5 | 15.64996836 | 0 | 41.06782312 | 43.28220852 |
| 6 | 18.95505226 | 0 | 40.75780315 | 40.28714458 |
| 6 | 33.94686562 | 0 | 66.05313438 | 0 |
| 7 | 19.91961213 | 0 | 39.85555782 | 40.22483005 |
| 7 | 19.65880461 | 0 | 40.51714733 | 39.82404806 |
| 8 | 18.1352621 | 0 | 39.33411059 | 42.5306273 |
| 8 | 18.08315652 | 0 | 36.86336989 | 45.0534736 |
| 9 | 16.63640155 | 0 | 42.20657705 | 41.1570214 |
| 9 | 0 | 0 | 47.04659626 | 52.95340374 |
| 10 | 17.28732879 | 0 | 44.4430471 | 38.26962411 |
| 10 | 18.42045959 | 0 | 43.36786405 | 38.21167636 |
| 11 | 15.41634507 | 5.777251588 | 47.81305271 | 30.99335063 |
| 11 | 15.53022148 | 5.876673994 | 48.02510302 | 30.5680015 |
| 12 | 19.49917252 | 0 | 38.91643922 | 41.58438826 |
| 12 | 18.60599973 | 0 | 43.10118732 | 38.29281295 |
| 13 | 16.52571391 | 0 | 44.53345323 | 38.94083286 |
| 13 | 16.83614491 | 0 | 44.53556402 | 38.62829107 |
| 14 | 17.31902508 | 0 | 44.73385871 | 37.9471162 |
| 14 | 17.59337621 | 0 | 44.15627312 | 38.25035067 |
| 15 | 16.66655495 | 0 | 40.30006991 | 43.03337515 |
| 15 | 16.47674733 | 0 | 40.22720148 | 43.29605119 |
| 16 | 14.80430436 | 0 | 42.18231207 | 43.01338357 |
| 16 | 14.64641488 | 0 | 41.28557279 | 44.06801233 |
| 17 | 14.89058061 | 0 | 40.65503792 | 44.45438147 |
| 17 | 15.11960224 | 0 | 42.21551556 | 42.6648822 |
| 18 | 21.60111156 | 0 | 35.20253206 | 43.19635638 |
| 18 | 21.53945178 | 0 | 35.92215553 | 42.53839269 |
| 19 | 14.59968145 | 0 | 46.15235081 | 39.24796774 |
| 19 | 15.99396739 | 0 | 46.06606039 | 37.93997222 |
| 20 | 15.85933919 | 0 | 37.38992226 | 46.75073855 |
| 20 | 16.58612233 | 0 | 35.16355855 | 48.25031912 |
| 21 | 0 | 0 | 0 | 0 |
| 21 | 0 | 0 | 0 | 0 |
| 22 | 15.11510247 | 0 | 40.54089337 | 44.34400415 |
| 22 | 15.21101652 | 0 | 40.07139379 | 44.71758969 |
| 23 | 15.92846115 | 0 | 39.99701032 | 44.07452853 |
| 23 | 14.52884677 | 0 | 40.76081734 | 44.71033589 |
| 24 | 14.18566746 | 3.198621707 | 42.24916305 | 40.36654779 |
| 24 | 14.20399839 | 3.268574811 | 42.50487569 | 40.02255111 |
| 25 | 17.97687713 | 3.564454649 | 48.01687211 | 30.44179612 |

| Sample | Palmitic acid | Stearic acid | Oleic acid | Linoleic acid |
|--------|---------------|--------------|-------------|---------------|
| 26 | 16.09169011 | 0 | 39.49861557 | 44.40969431 |
| 26 | 15.54998755 | 0 | 39.77291625 | 44.6770962 |
| 27 | 20.54149369 | 0 | 50.69872685 | 28.75977946 |
| 27 | 20.34698652 | 0 | 50.42240184 | 29.23061164 |
| 28 | 15.81041609 | 0 | 51.9212151 | 32.26836882 |
| 28 | 15.94218336 | 0 | 51.79311142 | 32.26470522 |
| 29 | 14.61920876 | 2.38580938 | 41.30698291 | 41.68799895 |
| 29 | 14.6686567 | 2.17610514 | 41.23111178 | 41.92412638 |
| 30 | 16.5374159 | 0 | 44.57885043 | 38.88373367 |
| 30 | 16.36968861 | 0 | 45.22256854 | 38.40774284 |
| 31 | 16.2998416 | 0 | 47.10794003 | 36.59221837 |
| 31 | 15.60521258 | 0 | 47.02505804 | 37.36972938 |
| 32 | 16.82486663 | 3.443344009 | 49.2397745 | 30.49201486 |
| 32 | 16.89377561 | 3.66515848 | 49.1752987 | 30.26576721 |
| 33 | 14.57291205 | 2.801677195 | 46.95743116 | 35.6679796 |
| 33 | 14.73576811 | 2.497562767 | 46.81455082 | 35.9521183 |
| 34 | 14.81764179 | 0 | 41.63607938 | 43.54627883 |
| 34 | 14.78804033 | 0 | 42.38544076 | 42.82651891 |
| 35 | 16.97687498 | 3.666060037 | 49.38778841 | 29.96927658 |
| 35 | 16.72419624 | 3.824109491 | 49.43611504 | 30.01557923 |
| 36 | 15.12225237 | 2.340730732 | 46.02706745 | 36.50994945 |
| 36 | 14.94195709 | 2.581254107 | 46.18470225 | 36.29208655 |
| 37 | 15.15363479 | 2.958472148 | 44.77190798 | 37.11598508 |
| 37 | 15.45273408 | 3.002114475 | 44.57557773 | 36.96957372 |
| 38 | 15.9334603 | 3.217597376 | 40.03111514 | 40.81782719 |
| 38 | 15.77251575 | 2.881129652 | 40.35267969 | 40.9936749 |
| 39 | 14.83863016 | 0 | 43.68348092 | 41.47788892 |
| 39 | 14.99828262 | 0 | 43.87237855 | 41.12933883 |
| 40 | 12.83046528 | 2.278437184 | 45.62088801 | 39.27020953 |
| 40 | 12.9514709 | 2.397844847 | 45.46884435 | 39.18183991 |
| 41 | 15.80479952 | 3.921220382 | 45.13731119 | 35.13666891 |
| 41 | 16.3006584 | 3.798153455 | 45.12338408 | 34.77780407 |
| 42 | 17.36443835 | 3.576723503 | 53.26245476 | 25.79638339 |
| 42 | 17.14285273 | 3.615659646 | 53.39731954 | 25.84416808 |
| 43 | 16.35630157 | 0 | 52.36258818 | 31.28111025 |
| 43 | 16.63989998 | 0 | 52.49774449 | 30.86235553 |
| 44 | 18.65546231 | 4.204898674 | 41.46331927 | 35.67631975 |
| 44 | 17.68404709 | 3.662260676 | 41.96832756 | 36.68536467 |
| 45 | 17.24830992 | 4.170369973 | 49.96414381 | 28.61717629 |
| 45 | 17.49666798 | 3.973859054 | 50.35355106 | 28.17592191 |
| 46 | 16.15166393 | 3.443603482 | 49.97019029 | 30.43454229 |
| 46 | 16.1297652 | 3.420209236 | 49.97092368 | 30.47910188 |
| 47 | 33.94938161 | 0 | 66.05061839 | 0 |
| 47 | 35.04013848 | 0 | 64.95986152 | 0 |
| 48 | 17.58554311 | 3.779787583 | 49.82589178 | 28.80877753 |
| 48 | 17.68406841 | 3.787999169 | 49.94741142 | 28.580521 |
| 49 | 18.47743588 | 0 | 49.8477841 | 31.67478002 |
| 49 | 18.21344817 | 0 | 49.44389095 | 32.34266088 |
| 50 | 17.83394542 | 3.804141478 | 48.66132774 | 29.70058536 |
| 50 | 18.04849095 | 3.364553684 | 49.13946738 | 29.44748799 |
| 51 | 17.05903605 | 3.537126944 | 55.18898825 | 24.21484875 |
| 51 | 17.13260172 | 3.511962534 | 55.55905531 | 23.79638044 |
| 52 | 18.00559905 | 4.052116302 | 47.69381009 | 30.24847456 |

| Sample | Palmitic acid | Stearic acid | Oleic acid | Linoleic acid |
|--------|---------------|--------------|-------------|---------------|
| 53 | 15.34919837 | 0 | 45.10117018 | 39.54963145 |
| 53 | 14.79030997 | 0 | 45.55642818 | 39.65326185 |
| 54 | 16.7156143 | 4.599420635 | 50.38775018 | 28.29721489 |
| 54 | 16.85464573 | 4.649580641 | 50.17015608 | 28.32561754 |
| 55 | 18.10700863 | 0 | 48.01092669 | 33.88206468 |
| 55 | 17.84700487 | 0 | 48.00860906 | 34.14438607 |
| 56 | 20.50390202 | 3.14581283 | 48.77558683 | 27.57469832 |
| 56 | 20.81402869 | 3.12483676 | 48.87616546 | 27.18496909 |
| 57 | 18.04684445 | 3.630880757 | 49.43416167 | 28.88811313 |
| 57 | 17.9217434 | 3.666763875 | 49.61970382 | 28.7917889 |
| 58 | 15.90756274 | 0 | 45.07133272 | 39.02110453 |
| 58 | 15.77717784 | 0 | 44.52668731 | 39.69613486 |
| 59 | 16.17846311 | 4.780566594 | 47.15682115 | 31.88414915 |
| 59 | 16.19663284 | 4.958357079 | 47.01049431 | 31.83451578 |
| 60 | 16.11705562 | 3.780848408 | 47.98076044 | 32.12133553 |
| 60 | 17.62798082 | 0 | 49.7181743 | 32.65384488 |
| 61 | 18.49931152 | 4.954770678 | 52.89513526 | 23.65078255 |
| 61 | 18.40314739 | 5.019668435 | 52.92123142 | 23.65595275 |
| 62 | 13.38011594 | 0 | 43.77104345 | 42.84884061 |
| 62 | 14.02975748 | 0 | 43.43288202 | 42.5373605 |
| 63 | 17.72824714 | 0 | 51.5235685 | 30.74818435 |
| 63 | 17.95905412 | 0 | 52.08933804 | 29.95160783 |
| 64 | 17.28002508 | 0 | 44.42193101 | 38.29804391 |
| 64 | 16.63549203 | 4.542378091 | 42.8953421 | 35.92678777 |
| 65 | 16.73679796 | 6.943286939 | 49.75249157 | 26.56742353 |
| 65 | 16.77011595 | 7.256054003 | 49.57494832 | 26.39888173 |
| 66 | 13.18599505 | 0 | 45.58781991 | 41.22618504 |
| 66 | 12.91673995 | 0 | 45.96946212 | 41.11379793 |
| 67 | 16.86199546 | 0 | 44.81300081 | 38.32500372 |
| 67 | 16.99471653 | 0 | 44.73905001 | 38.26623346 |
| 68 | 0 | 0 | 0 | 0 |
| 68 | 0 | 0 | 0 | 0 |
| 69 | 15.98914147 | 0 | 45.10335295 | 38.90750558 |
| 69 | 16.16651144 | 0 | 44.56216933 | 39.27131923 |
| 70 | 16.30889999 | 0 | 45.13421877 | 38.55688124 |
| 70 | 16.5955531 | 0 | 45.50955015 | 37.89489675 |
| 71 | 16.76052798 | 0 | 50.87099964 | 32.36847238 |
| 71 | 16.00618329 | 3.921433531 | 49.20204506 | 30.87033812 |
| 72 | 16.41995516 | 4.087416523 | 46.79824133 | 32.69438699 |
| 72 | 16.24796481 | 4.108915505 | 46.58083953 | 33.06228015 |
| 73 | 15.8727649 | 3.399981855 | 47.53590109 | 33.19135215 |
| 73 | 16.56370234 | 0 | 49.23650522 | 34.19979244 |
| 74 | 15.42866134 | 3.75759993 | 49.91812915 | 30.89560958 |
| 74 | 15.34854661 | 3.829211079 | 50.36765319 | 30.45458912 |
| 75 | 18.02739763 | 0 | 48.83263986 | 33.13996251 |
| 75 | 17.63443176 | 0 | 48.56182975 | 33.80373849 |
| 76 | 22.16080024 | 0 | 45.31471848 | 32.52448128 |
| 76 | 19.50679477 | 0 | 46.50834191 | 33.98486332 |
| 77 | 14.25850067 | 0 | 46.19043472 | 39.55106461 |
| 77 | 14.47715007 | 0 | 45.39628528 | 40.12656465 |
| 79 | 17.00048771 | 0 | 48.68468282 | 34.31482947 |
| 79 | 16.88228432 | 0 | 48.02524104 | 35.09247464 |
| 80 | 16.0147895 | 4.67401816 | 51.51076906 | 27.80042329 |

| Sample | Palmitic acid | Stearic acid | Oleic acid | Linoleic acid |
|--------|---------------|--------------|-------------|---------------|
| 81 | 17.79924626 | 0 | 52.5861258 | 29.61462794 |
| 81 | 17.836732 | 0 | 51.39524802 | 30.76801998 |
| 82 | 18.00766528 | 0 | 49.22918527 | 32.76314945 |
| 82 | 18.72193073 | 0 | 48.76818686 | 32.50988241 |
| 83 | 19.42595388 | 0 | 42.46525696 | 38.10878917 |
| 83 | 19.36144827 | 0 | 42.11899235 | 38.51955937 |
| 84 | 17.6506284 | 0 | 49.9873236 | 32.362048 |
| 84 | 18.26664409 | 0 | 49.95622226 | 31.77713365 |
| 86 | 17.35691599 | 3.679924006 | 48.30642138 | 30.65673862 |
| 86 | 17.56949 | 3.642487991 | 47.94079842 | 30.84722359 |
| 87 | 15.676233 | 3.354148243 | 45.5293021 | 35.44031666 |
| 87 | 15.6665115 | 3.484602458 | 45.72240149 | 35.12648455 |
| 88 | 0 | 0 | 0 | 0 |
| 88 | 0 | 0 | 0 | 0 |
| 89 | 18.06484627 | 0 | 52.97612279 | 28.95903094 |
| 89 | 17.58611248 | 0 | 53.24955478 | 29.16433274 |
| 90 | 17.15479272 | 3.400338288 | 48.92786 | 30.51700899 |
| 90 | 17.11478652 | 3.560411548 | 49.02452703 | 30.3002749 |
| 91 | 16.67427584 | 3.352159383 | 49.60570635 | 30.36785842 |
| 91 | 16.62939068 | 3.375061418 | 49.82727373 | 30.16827417 |
| 92 | 17.453955 | 0 | 48.52676095 | 34.01928405 |
| 92 | 17.07226587 | 0 | 49.38752093 | 33.5402132 |
| 93 | 14.90118174 | 0 | 45.64690081 | 39.45191746 |
| 93 | 14.38440265 | 0 | 46.71785476 | 38.89774258 |
| 94 | 19.07135367 | 0 | 52.01474649 | 28.91389984 |
| 94 | 18.94918756 | 0 | 52.84181715 | 28.20899529 |
| 95 | 27.1834145 | 0 | 72.8165855 | 0 |
| 95 | 17.65097122 | 0 | 49.98517831 | 32.36385047 |
| 96 | 17.87486475 | 4.3426492 | 53.51671671 | 24.26576934 |
| 96 | 17.97290397 | 4.569015241 | 53.57139885 | 23.88668193 |
| 97 | 17.62060323 | 0 | 51.14491579 | 31.23448098 |
| 97 | 17.96939519 | 0 | 51.14831738 | 30.88228743 |
| 98 | 14.89305401 | 0 | 44.06939357 | 41.03755242 |
| 98 | 14.92694451 | 0 | 44.29129503 | 40.78176046 |
| 99 | 14.60867948 | 4.33639712 | 51.41642236 | 29.63850105 |
| 99 | 14.63826155 | 4.341139339 | 51.3391274 | 29.68147171 |
| fame 5 | 33.56946716 | 0 | 44.29465406 | 22.13587877 |
| 101 | 17.14156425 | 0 | 50.90662108 | 31.95181467 |
| 101 | 17.14619815 | 0 | 51.24158465 | 31.6122172 |
| 102 | 15.78184437 | 0 | 44.55428146 | 39.66387417 |
| 102 | 15.79669365 | 0 | 46.56853778 | 37.63476858 |
| 103 | 16.79694416 | 0 | 40.76089425 | 42.44216158 |
| 103 | 16.74045598 | 0 | 44.0514333 | 39.20811072 |
| 104 | 16.91166477 | 0 | 49.52784359 | 33.56049163 |
| 104 | 17.14915416 | 0 | 50.61241707 | 32.23842878 |
| 105 | 14.3669681 | 0 | 47.80806723 | 37.82496467 |
| 105 | 13.99228587 | 0 | 43.16078602 | 42.84692811 |
| 106 | 17.55760175 | 1.879087978 | 47.77949503 | 32.78381524 |
| 106 | 16.41707324 | 6.430473096 | 43.542734 | 33.60971966 |
| 107 | 16.82311485 | 0 | 39.32203303 | 43.85485212 |
| 107 | 17.88553832 | 0 | 39.08478915 | 43.02967253 |
| 108 | 16.54264123 | 0 | 38.58051832 | 44.87684045 |
| 108 | 16.25988615 | 0 | 42.51539449 | 41.22471936 |

| Sample | Palmitic acid | Stearic acid | Oleic acid | Linoleic acid |
|--------|---------------|--------------|-------------|---------------|
| 109 | 14.7883414 | 0 | 44.69447868 | 40.51717992 |
| 110 | 18.21298848 | 0 | 52.05893777 | 29.72807376 |
| 110 | 18.34857356 | 0 | 51.82594698 | 29.82547946 |
| 111 | 14.96227107 | 0 | 46.76607967 | 38.27164926 |
| 111 | 16.38105684 | 0 | 44.59073513 | 39.02820802 |
| 112 | 15.28380343 | 0 | 42.6401854 | 42.07601118 |
| 112 | 15.50299503 | 0 | 43.48162808 | 41.01537689 |
| 113 | 17.08578469 | 0 | 46.36534285 | 36.54887246 |
| 113 | 17.59469851 | 0 | 46.67480699 | 35.7304945 |
| 114 | 20.57618733 | 0 | 43.09466984 | 36.32914283 |
| 114 | 20.52044786 | 0 | 44.43757897 | 35.04197318 |

Conclusion: The above results indicated that all the varieties contained high quantities of Oleic acid (C 18:1 Monounsaturated fatty acid), followed by Linoleic acid. (C18:2, polyunsaturated fatty acid containing two double bonds), followed by palmitic acid (C 16 Saturated fatty acid) and very minute quantities of Stearic acid (C18:0 saturated fatty acid).

Acknowledgments: We would like to acknowledge Dr. Kurt Lawrence, Research Leader, USDA-ARS, Quality and Safety Assessment Research Unit, Russell Research Center, Athens, Georgia for allowing us to use HPLC equipment for analysing fatty acid content.