SUMMARY

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The following lines summarize the various topics which were handled in the present investigation to study physical and chemical properties of different varieties of rapeseed oil and glucosinolate contents besides the evaluation of blending palm oil and its fractions with rapeseed and/or sunflower.

The method of introducing this summary follows to a great extent the line of approach used in the presentation of the various topics dealt with in this dissertation.

I. Different rapeseed varieties:

1- Chemical and mineral constituents of rapeseed varieties:

Fourteen rapeseed varieties (Brassica napus) were used in the present study. The oils were extracted from the crushed seeds through pure n-hexane. The percentage of oil extracted ranged from 40.30% to 44.96%. Moisture content ranged from 7.45% to 8.40%. Crude protein contents of rapeseed samples showed highest value in Hanna variety while Bruter variety contain Lower value i.e. 20.30%. Total charbohydrate ranged from 18.50% to 24.50%. Ash content ranged from 4.52% to 5.27%.

All varieties of rapeseed contain relatively rich values in Na, K, P and Ca.

2. Amino acid compositions of rapeseed varieties:

Amino acid compositions of the samples under study indicated that glutamic, asparatic and prolein acids are the most abundant amino acids in all varieties, followed by lysine and leucine + isoleucine. Moreover histadine is present in minute quantities.

3. Total glucosinolates and its individual components of rapeseed varieties:

Varieties of Weibub, Orpal 95C and Altex contained relatively high amounts of the total glucosinolate i.e. 58.6, 73.8 and 81.2 $\mu molg^{-1}$ respectively, while the lowest amount was found in Hanna variety reached to 20.3 $\mu molg^{-1}$.

Different seed varieties under study possessing 3-butenyl-, 4-pentenyl-, 2-OH-3-butenyl-, 2-OH-4-pentenyl-, ally-, *P*-OH-benzyl- and 4-OH-3-indolylmethyl-glucosinolates. The obtained data showed that 2-OH-3-butenyl-glucosinolates (progoitrin) was found as the major compound followed by 3-butenyl-glucosinolate.

On the other hand, allyl- and *P*-OH-benyzl-glucosinolate were detected in trace amount in most of different rapeseed species.

4. The physical and chemical properties of rapeseed oils:

The samples under investigation were subjected to determined the physical and chemical properties after oil extraction which includes refractive index, specific gravity, acid value, iodine value, saponfication value, peroxide value and unsaponifiable matter percent.

5. Fatty acid compositions of rapeseed oils varieties:

Fourteen varieties of rapeseed oils were analyzed by GLC. Saturated fatty acids palmetic ($C_{16:0}$) and stearic ($C_{18:0}$) amounted between (3.4%-5.6%) and (1.3%-1.7%) resepectively. Arachidic acid ($C_{20:0}$) and behenic ($C_{22:0}$) were detected in lower amounts, while myristic acid ($C_{14:0}$) was not detected. Oleic acid ($C_{18:1}$) was the most prevalent unsaturated fatty acid ranged from 36.3% to 60.3%. Linoleic acid ($C_{18:2}$) ranged from 16.0% to 21.2%, while linolenic acid ($C_{18:3}$) was present in relatively small amounts. Moreover, gadoleic ($C_{20:1}$) and erucic acid ($C_{22:1}$) were detected in high amounts in Weibub, Hohenheimer, Orpal 95C and Regent varieties and ranged between (9.8% and 9.1%), (8.7% and 11.6%), (11.7% and 14.0%) and (11.75 and 16.2%) respectively. Ro Meo T variety yield a little amount of gadoleic and erucic acids. The ratios between total unsaturated to total saturated acid (TU/TS) ranged from (11.4:1) to (15.5:1) in all samples under study. Such values were higher than the values recommended for common edible oils.

6. Fractionation and identification of unsaponifiable matter components of rapeseed oils varieties:

Unsaponifiable matter of fourteen varieties oils were separated by using TLC technique and analyzed by using capillary column gas liquid chromatography. The total hydrocarbon of the different varities contained 17 different components amounted from 64.30% to 84.11% of the total unsaponifiable matter. The major hydrocarbon wsa C_{25} ranged from 54.37% to 76.77%.

β-sitosterol is the major sterol and ranged from 52.31% to 61.48%. Brassica and campesterol were detected in relatively moderate amounts ranged between 10.55% to 21.67% and 17.90% to 26.86%. Stigmasterol were present in small amounts and ranged from 3.21% to 7.93% in all the samples under investigation.

II. Oil blends:

1. Physicochemical properties of some edible oils and blends:

Physicochemical properties of palm oil, palm olein RBD, palm olein DF, rapeseed oil, sunflower oil and blends of these oil were determined. Specific gravity is always less than 1.00. Refractive index of rapeseed and sunflower oils showed high values. Melting point of palm oil, palm olein RBD and palm olein DF had 40°C, 21.5°C and 14.0°C respectively. While the oils of rapeseed and sunflower had the lowest melting point i.e. -27°C and -22°C respectively. Iodine value of sunflower oil was relatively high i.e. 116.93 compared to other oils under study.

Blending rapeseed oil or sunflower oil with palm olein RBD or palm olein DF caused iodine value decreased, it decreased from 97.30 in the (9:1, rape:palm olein RBD) to 79.43 in the (5:5, rape:palm olein RBD), while iodine value decreased from 111.74 in the (9:1, sunflower:palm olein DF) to 87.41 in (5:5, sunflower:palm olein DF).

The saponification values of palm oil, palm olein RBD, palm olein DF and sunflower oil ranged from 192.90 to 194.50. Blending of rapeseed oil with palm olein RBD or palm olein DF caused saponification value increased from 178.20 in the (9:1, rape:palm olein DF) to 184.40 in the

(5:5, rape:palm olein DF), while saponification value decreased from 191.45 in (9:1, sunflower:rape) to 184.85 in (5:5, sunflower:rape).

Low peroxide values ranging from (0.17 to 3.89) in different oil samples under study. On the other hand, rapeseed oil blended with sunflower led to high peroxide values ranged from (8.6 to 19.78). The conjugated diene fatty acids of oils under investigation and their blends ranged from (0.09% to 0.60%). Pure oils and blending under investigation almost have the same contents of unsaponifiable matter ranged between (0.54% to 0.82%).

2. The stability of some edible oils and blends:

Palm oil, palm olein RBD and palm olein DF have the longest induction periods i.e. 44.2, 42.9 and 21.8 hrs respectively. While such oils melts at 40.0, 21.5 and 14.0°C respectively. On the other hand, the induction period of sunflower oil was a relatively lowest value i.e. 6.2 hrs at 100°C. Such oil melts at -22°C. Rapeseed oil gave a relatively moderate induction period i.e. 14.8 hrs and melts at -27°C.

It has been showed that induction period of rapeseed oil are approximately 2.5 folds than that of sunflower oil; although the ratios between unsaturated:saturated for rapeseed is greather than that of sunflower i.e. (15.55:1) for the former while such ratios amounted (8.66:1) for the latter. This attributed to the sunflower oil which concerning significant high levels of unsaturated fatty acid especially lenoleic acid ($C_{18:2}$) i.e. 65.12%.

A blend of sunflower oil with palm olein DF resulted in a noticeable increase in the induction period especially in the ratios of (7:3) and (5:5). The induction period of sunflower 6.2hrs increased to 11.3 and to 14.2hrs and melts at -12 and -10°C respectively.

Blending rapeseed oil with palm olein RBD or palm olein DF caused a relatively lowest increase in the induction period comparing with a blending of sunflower oil with palm olein RBD or palm olein DF.

Blending of rapeseed oil with both sunflower oil and palm olein RBD or palm olein DF in the ratios of (1:1:2) preduced a noticeable increase in the induction period.

3. Fatty acid compositions of some edible oils and blends:

The major constituents of unsaturated fatty acid in palm oil were $C_{18:1}$, $C_{18:2}$ and $C_{18:3}$. Oleic acid ($C_{18:1}$) was the most prevalent unsaturated fatty acid i.e. 41.53%. Linoleic acid ($C_{18:2}$) was detected in lower amount i.e. 11.06%, while saturated fatty acids include 43.08% palmitic acid ($C_{16:0}$) and 3.03% stearic acid ($C_{18:0}$).

Oleic and palmitic acids in palm olein RBD and palm olein DF amounted 40.40% and 37.83% for the former and 44.13% and 37.13% for the latter.

Palmitic and stearic acids were detected in sunflower oil with a relatively low amounts, while linolenic acid ($C_{18:3}$) and arachidic acid amounted 0.28% and 0.23% respectively.

Linoleic acid ($C_{18:2}$) and olecic acid ($C_{18:1}$) were detected in highest amounts i.e. 65.12% and 24.22% respectively.

Palm olein RBD or palm olein DF in the present investigation were blended with either rapeseed oil or sunflower oil at different ratios. The data revealed that linolenic acid decreased from 9.91% in rapeseed oil to 5.62%, 6.27% and 5.47% at the ratios (5:5) of (rape:palm olein RBD), (rape:palm olein DF) and (rape:sunflower) respectively.

Total saturated fatty acids in rapeseed oil was increased from 6.04% to 27.13% and 20.58% in the blended oils at ratios (5:5) of (rape:palm olein RBD) and (rape:palm olein DF) respectively.

Blending sunflower oil with palm olein RBD, palm olein DF and rapeseed oil showed that oleic acid was increased from 24.22% in sunflower oil to 31.80%, 33.78% and 33.56% in the (sunflower:palm olein RBD, 5:5), (sunflower:palm olein DF, 5:5) and (sunflower:rape, 5:5), respectively. While linoleic acid was decreased sharply from 65.12% in sunflower to 36.06%, 38.76% and 39.59% respectively in the previous blends under experiment.

The data indicated that the blends of (rape:sunflower:palm olein RBD) and (rape:sunflower:palm olein DF) at ratios (1:1:2) gave encouragement results for blending.

It is noticed that the blends at ratios (5:5) of sunflower oil with palm olein RBD or palm olein DF gave the best ratios for saturated(S):monounsaturated(M): polyunsaturated(P) i.e. 1:1.01:1.15 and 1:1.26:1.45. Such ratios were followed by blending of rapeseed oil with both sunflower oil and palm olein DF or palm olein RBD at ratios (1:1:2). The values reached to 1:1.56:1.01 and 1:1.57:1.11 for S:M:P.

Calculated oxidizability is inversely proportional to stability of blending oils which was calculated as:

0.2 (oleic %) + (linoleic %) + 2 (linolenic %) /100 GC area percent compositions according to **Neff *et al.* (1994)**. The data showed that the oxidizability of rapeseed oil i.e. (0.454) was decreased to (0.351) and (0.357) at ratios (5:5) of blending rape with palm olein RBD or palm olein DF respectively. On the other hand, the oxidizability of rapeseed oil (0.454) led to increase by blending with sunflower oil. Such value reached to (0.562) at ratio (5:5). The increase in oxidizability may be attributed to decreasing in oleic acid content and increasing in linoleic acid content by blending.

The calculated oxidizability of sunflower oil was (0.705). However, this value was decreased to (0.434), (0.460) and (0.571) for (sunflower:palm olein RBD), (sunflower:palm olein DF) and (sunflower:rapeseed oil) at the same ratio (5:5) respectively.

It could be deduced that blending of rapeseed oil or sunflower oil with palm olein RBD or palm olein DF would be expected to improve the stability of such oils. In addition, the ratios of linoleic ($C_{18:2}$) and linolenic ($C_{18:3}$) to oleic ($C_{18:1}$) were decreased in the blending oils under investigations.

4. The unsaponifiable matter of some edible oils and blends:

The hydrocarbons of palm oil and its fractions contain C_{21}, their values were from 20.25% to 24.88% for palm olein DF and palm olein RBD respectively, followed by C_{30}, C_{28}, C_{25}, C_{24}, C_{23} and C_{20}. C_{16} and C_{22}

were amounted (<5.0%). β-sitosterol was the major sterol fraction of total sterol followed by campesterol and stigmasterol.

The hydrocarbon of the rapeseed oil constituted the major part of the unsaponifiable which contained 9 different components amounted 69.11% of the total unsaponifiable matter oil of rapeseed under investigation. C_{25} was a major constituent amounted 41.10% while C_{22} was present in moderate amounts, other hydrocarbons C_{20}, C_{21}, C_{23}, C_{24}, C_{26}, C_{28} and C_{30} were found in relatively small amounts. β-sitosterol was the main sterol comprised as 16.91% while campesterol was present in moderate amount 6.16%. Brassica sterol which is characterizing the Brassica oil and amounted 4.30%.

Eight hydrocarbons were identified in sunflower oil. The main hydrocarbons were C_{28} and C_{25}, which represents as 16.75% and 9.13% from the total unsaponifiable matter respectively. Stigmasterol, campesterol and β-sitosterol were detected in sunflower oil. β-sitosterol is the major sterol content 47.21%.

Blending rapeseed oil with palm olein RBD, palm olein DF and sunflower led to decrease in C_{25} hydrocarbon. Its value decreased from 41.10% in pure rapeseed oil to 21.33%, 22.12% and 27.32% in (rape:palm olein RBD, 5:5), (rape:palm olein DF, 5:5) and (rape:sunflower, 5:5).

Brassicasterol decresaed from 4.30% for pure oil to 2.70%, 2.64% and 2.36% at the ratio (5:5) of (rape:palm olein RBD), (rape:palm olein DF) and (rape:sunflower) respectively. However β-sitosterol increased

from 16.91% in pure oil to 18.09%, 20.73% and 32.09% in (rape:palm olein RBD, 5:5), (rape:palm olein DF, 5:5) and (rape:sunflower, 5:5).

Blending sunflower oil with palm olein RBD, palm olein DF or rapeseed oil led to decreased in C_{23} hydrocarbon. Its value decreased from 16.75% to 11.62%, 10.99% and 9.82% in blending (sunflower:palm olein RBD, 5:5), (sunflower:palm olein DF, 5:5) and (sunflower:rape, 5:5) respectively, while total sterols decreased from 55.72% in pure sunflower oil to 41.20%, 44.95% and 45.82% in same blending oils.