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A survey of tocopherol (Vitamin E) content in commercially bought flax supplements.

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Abstract:

A small study on tocopherol content of store-bought flax supplement was initiated at our laboratory. Seven different flax supplements were purchased from one online source. Four of the flax supplements were in gel caps and were of four different brands, two different flax oils were purchased, and two whole seed from one brand. Gamma tocopherols was found in all flax supplements. Gel caps and oil supplements showed the highest concentration of gamma tocopherol. Three flax supplements show presence of alpha-tocopherol. We therefore conclude that flax supplements are a good source of alpha-linolenic acid and lignans, and gamma tocopherol as well.

Introduction:

Flax (*Linum usitatissimum*) is valued because it is rich in alpha-linolenic (omega-3) acid and lignans. However, flax is also rich in tocopherols (vitamin E). Tocopherols are important anti-oxidants, and they enhance the oxidative stability of oils (Oomah et al, 1997 and Bezin). There are four major tocopherols found in oil seed crops: alpha, beta, delta, and gamma tocopherols. These four classes are further subdivided in tocotrienols. A typical chemical structure is shown in figure 1.

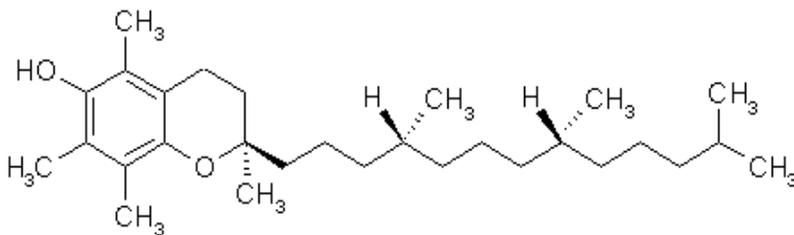


Figure 1. Typical chemical structure of alpha-tocopherol (Courtesy: Sigma Aldrich).

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Tocopherols are found in oil seed crops such as canola, flax, poppy, safflower, sunflower, soybeans and others (Maguire et al., 2004; Oomah et al., 1997; Ortega-García et al., 2006, and Perretti et al., 2004). Alpha-tocopherol is predominant in safflower, whereas gamma tocopherol is the predominant tocopherol in flax and poppy.

Oomah et al. (1997) studied 8 different flax cultivars at varying locations in Canada. These authors found tocopherol content to be cultivar, location, and environment specific. The average tocopherol content across the 8 cultivars was 9.3 mg/100g. Gamma tocopherol represented 96% of all tocopherols found (Oomah et al, 1997). In a more recent study, Bozan and Temelli (2008) found 14.6 mg/100 mg tocopherols in Turkish grown flax. These authors too, found gamma tocopherol to be the predominant tocopherol in flax.

The above research indicates that flax is not only rich in alpha-linolenic acid and lignans but also in gamma tocopherol. Flax supplements usually provide information on alpha-linolenic acid and lignan content. The labels on the flax supplements typically do not provide information on the apparently important tocopherols. Our objective, therefore, was to determine the tocopherol content in commercially available flax supplements.

Materials and Methods:

Seven commercially available flax products (oils, seed, and gel capsules) were bought from one online source February 2010. We bought 4 different brands of gel caps and 2 different brands of flax oil. The flax seed and roasted seed were of the same brand. Data was taken on the claimed omega-3 content of the product. One brand (soft gel brand 1) had added tocopherols ---see table 1.

Tocopherol Extraction:

Flax seed was ground to meal, and 1.0 gram was taken for tocopherol extraction. Gel caps were carefully cut open and 1.0 gram was taken for extraction. Tocopherols were extracted from oil and seed in a 50.0 ml centrifuge tube containing: EtOH, KOH, n-hexane and distilled water. The samples were left in a 50 C water bath for 1 hour, with occasional shaking. The samples were then centrifuged at 6,000 rpm for 20 minutes. One (1) ml of the top layer (hexane) was taken and put immediately on the HPLC apparatus.

HPLC Analysis:

A HP 1090-II apparatus was equipped with a Restek Pinnacle II normal phase column (Restek Corporation, PA). An isocratic solvent delivery system was used containing 0.6% iso-propanol and 99.4% n-hexane. Tocopherols were detected using a UV-DAD detector set at 295 nm. Pure standards of alpha, beta, delta, and gamma tocopherols were first injected to generate a standard curve for later quantification of the flax samples.

Results and Discussion:

One flax supplement soft gel contained ‘added tocopherols’ according to the manufacturer’s label. This soft gel flax supplement did show increased gamma tocopherol content and is represented as ‘SG-1’ in figure 2 and table 1. The other soft gel supplements showed significantly lower gamma tocopherol content. However, soft gel brand number 4 had a higher gamma tocopherol content than the two other soft gel brands as well as the oils, meal and roasted seed. The two oil brands gave intermediate results in gamma

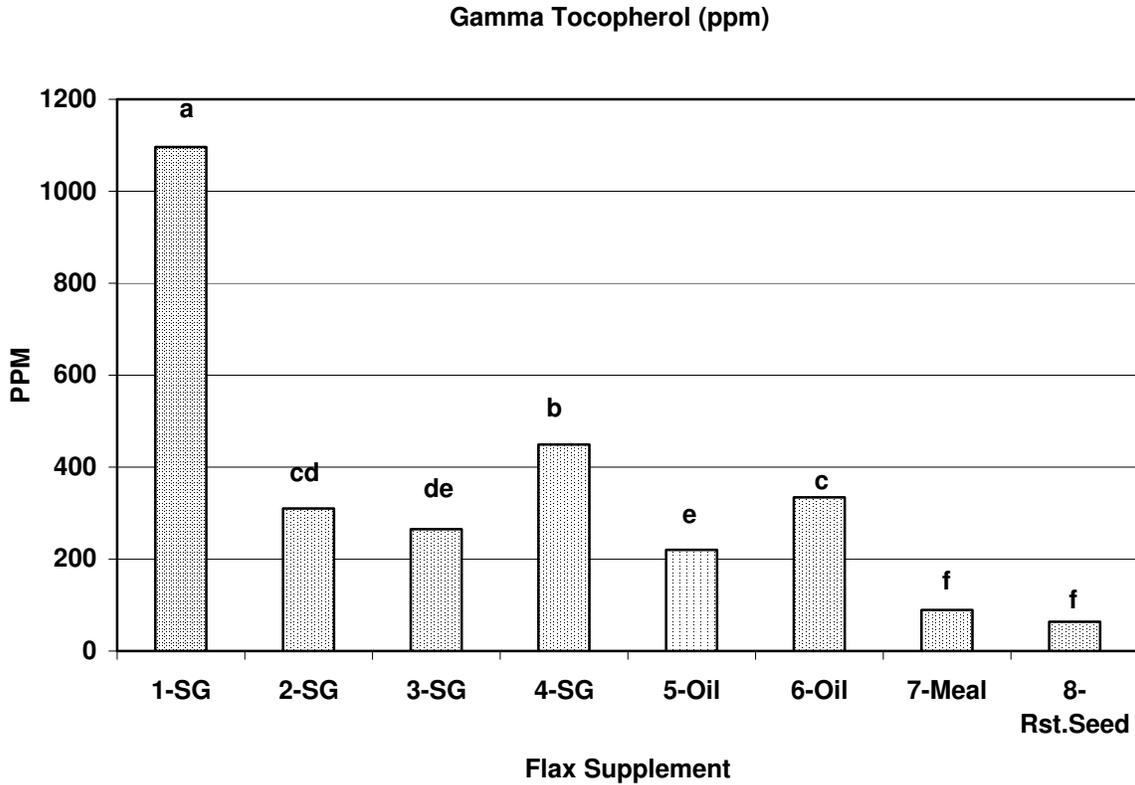


Figure 2. Gamma tocopherol content (ppm) in 7 flax supplements. SG=soft gel; oil=oil in bottle, meal=ground flax seed, RST-Seed=roasted flax seed. Different letters above bars denote statistical difference at the 0.05% level.

tocopherol content. Oil brand no. 6 had a similar gamma tocopherol content compared to soft gel brand no. 2. Soft gels contain flax oil and therefore it is to be expected that the oil gamma tocopherol data are somewhat in the range of the soft gels. Flax meal and roasted seed showed the lowest amount of gamma tocopherols. These low amounts are expected since oil extraction concentrates tocopherol content. Seed roasting gave a lower amount of gamma tocopherol 63.9 ppm vs. 89.5 ppm in flax mea (Table 1), although this was statistically not significant. These data might indicate that roasting e.g. high temperatures reduce gamma tocopherol content.

Only three flax supplements showed alpha-tocopherol. SG-1 was expected to show alpha-tocopherol since the manufacturer added tocopherols. SG-2 and SG-4 (different brands) showed alpha-tocopherol. It would be interesting to see what flax cultivars these manufactures used for their flax supplements. All other supplements did not show alpha-tocopherol

Conclusions:

This small-scale study showed varying contents of gamma tocopherol in the 7 flax supplements studied. Therefore, these flax supplements have 'value added' to them by containing gamma tocopherol. Tocopherols are believed to be beneficial to human health. Furthermore, tocopherols enhance oxidative stability to oils. Flax supplements with tocopherols in them may therefore have a longer shelf life than supplements without tocopherols. The above data warrant a further study of shelf life of flax supplements undertaken in our laboratory.

ID	Format	Tocos Added	Claimed Omega-3 (mg)	Gamma-Tocopherol (ppm)	Alpha-Tocopherol (ppm)
1	SG	Y	1,650	1096.4	2082.7
2	SG	N	754	309.9	195.3
3	SG	N	500	265.1	0.0
4	SG	N	540	449.3	311.0
5	Oil	N	6,975	220.1	0.0
6	Oil	N	7,700	334.2	0.0
7	Meal	N	NA	89.5	0.0
8	Seed (RST)	N	NA	63.9	0.0

Table I: Flax Supplement Data. Format: SG=soft gel with oil; Oil= oil from a bottle; meal is ground flax seed; RST= roasted seed. Claimed omega-3 data were listed by the different manufacturers on the labels. Alpha and gamma tocopherol content (ppm) were determined in this study. Note SG-1 had added tocopherols and thus increase amounts of alpha- and gamma tocopherol.

References:

Bozan, B. and F. Temelli. 2008. Chemical composition and oxidative stability of flax, safflower and poppy seed and seed oils. *Bioresource Technology*. 99:6354-6359.

Maguire, L.S., S.M. O’Sullivan, K. Galvin, T.P. O’Conner, and N.M. O’Brien. 2004. Fatty acid profile, tocopherol, squalene and phytosterol content of walnuts, almonds, peanuts, hazelnuts and macadamia nut. *International Journal of Food Sciences and Nutrition*. 55:171-178.

Oomah, B.D., E.O. Kenaschuk, and G. Mazza. 1997. Tocopherols in flaxseed. *J. Agric. Food Chem.* 45:2076-2080.

Ortega-García, J, N. Gámez-Meza, J.A. Noriega-Rodríguez, O. Dennis-Quiñonez, H.S. García-Galindo, J.O. Angulo-Guerrero, and L.A. Medina-Juárez. 2006. Refining of high oleic safflower oil: Effect on the sterols and tocopherols content. *Eur. Food Res. Tech.* 223:775-779.

Perretti, G. E. Finotti, S. Adamuccio, R. Della Sera, and L. Montanari. 2004. Composition of organic and conventionally produced sunflower seed oil. *JAOCS*. 81:1119-1123