

## «Omega-6/Omega-3 fatty acid balance and skin elasticity»

The study was performed by BioActive Foods in cooperation with Zinzino AB, to investigate the effect of BalanceOil on the elasticity of the skin.

### Participants

In total 50 female voluntaries participated in the study. The initial criteria for participation were mother and daughter pairs. The participants were in the age groups 16-66 years.

The participants were divided into two groups; one group consumed 2 table spoons of BalanceOil daily, while the other group functioned as a control group, meaning that they followed their daily diet without any intake of omega-3 supplements in the test period.

### Methods

The study can be divided into a main part and an additional part. The main part of the study lasted for 60 days and started with 50 participants. In the additional part of the study, measurements were performed on a group of 10 persons from the test group which continued the intake of 0,15 ml BalanceOil x body weight from day 60 to day 200.

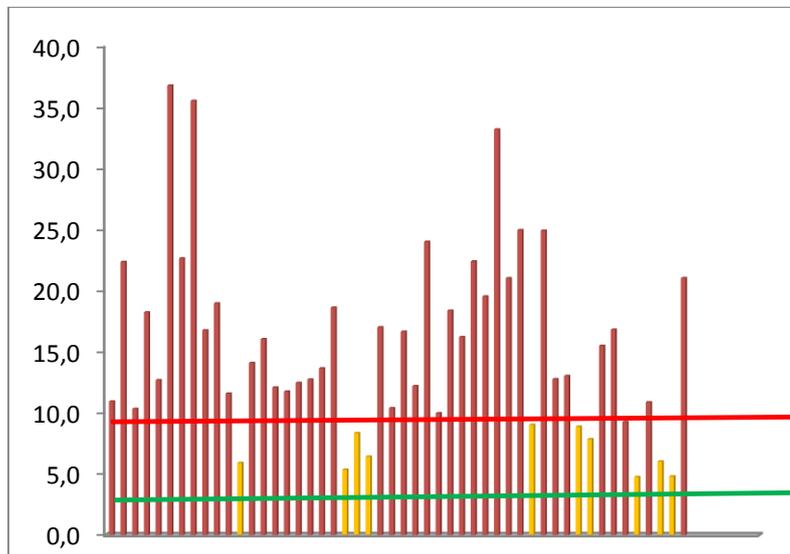
BalanceTest was used to measure the participant's fatty acid profile in whole blood at 0, 30, 60 and 200 days. The blood samples were collected and sent to Vitas AS for analysis.

The skins elasticity were measured with a Cutometer MPA 580 (Courage + Khazaka electronic GmbH, measuring mode 1, negative pressure 425 mbar) at day 0, 30, 60 and 200 in the area below the eye. The measurements were performed in 3 parallels.

Statistical analysis (ANOVA) were performed in R ver 2.12.2

## Results

### -Fatty acids in whole blood

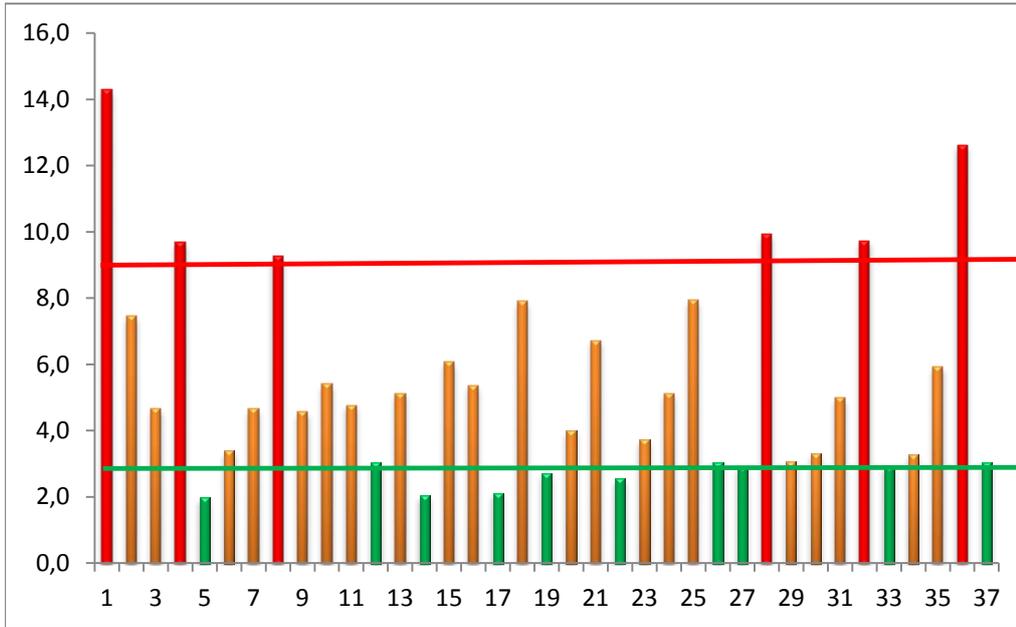


**Figure 1.** Omega-6/Omega-3 balance (AA/EPA) for individual participants at **Day 0**. Red line indicates a omega-6/omega-3 balance above 9:1, while under the green line the omega-6/omega-3 balance is less than 3:1.

#### **Omega-6/Omega-3 balace at Day 0:**

- Average value in the group of participants (n=50)	15:1
Omega-3 level ( EPA+DHA):	
- Average value in the group of participants (n=50)	3,8 %
Omega-6/Omega-3 balance mothers (n=25):	
-Average	12:1
Omega-6/Omega-3 balance daughters (n=25):	
-Average	18:1

The results at day 0 shows that the average omega-6/omega-3 balance for the group of participants is 15:1 and the omega-3 level is 3.8 %, which indicates that the dietary intake of omega-6 is higher than omega-3. A ratio of 15:1 is higher than for the average Norwegian population (internal data BioActive Foods).



**Figure 2.** Omega-6/Omega-3 balance ) for individual participants in the **Test group** at **Day 30**. Red line indicates an omega-6/omega-3 balance above 9:1, while under the green line the omega-6/omega-3 balance is less than 3:1

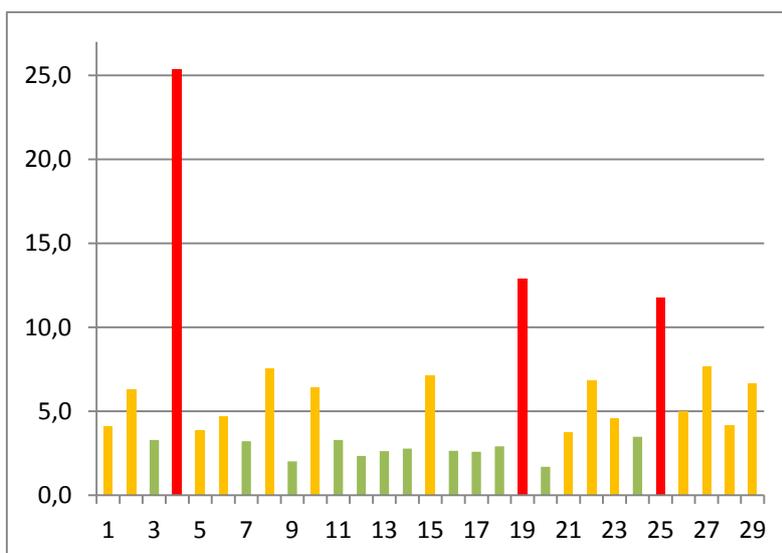
Omega-6/Omega-3 balance day 30:

- Average in test group (n=37) 5,4:1

Omega-3 level (EPA+DHA):

- Average in test group (n=37) 5 %

After intake of 2 table spoons of BalanceOil for 30 days, the test group had an average omega-6/omega-3 balance of 5.4:1. Nordic Council of Ministers recommend an omega-6/omega-3 balance of 5:1 or less.



**Figure 3.** Omega-6/Omega-3 balance for individual participants in the **Test group** at **Day 60**.

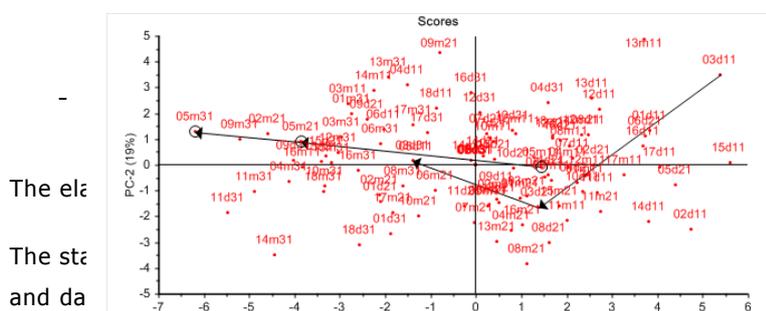
Omega-6/Omega-3 balance day 30:

- Average in test group (n=29) 4,8:1

Omega-3 (EPA+DHA)level:

- Average in test group (n=29) 6,4 %

The results at day 60 show a clear change in fatty acid profile from day 0 for the participants in the test group, which is also illustrated in the PCA plot below, indicated by the black arrows.



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from the participants in the age group 35-66, since it is mainly in this age group that the skins elasticity starts to decrease and it is therefore a possibility to find changes. The skins elasticity can be reduced by several factors, such as age and exposure to sun and UVR.

The results showed significant differences ( $p < 0.05$ ) in the skins elasticity between the test group and the control group at day 60.

The long chained fatty acids EPA and DHA affects the membrane fluidity of the cells, in addition EPA and DHA are precursors to signaling molecules that can increase the blood flow to the skin and hence increase the production of collagen and elastin which is important for the elasticity of the skin (Segger et al 2008 J Dermatological Treatment).



Additional measurements (BalanceTest and skin measurements) were performed at day 200 on a group of 10 participants from the test group which had continued with the an intake of 0.15 ml BalanceOil x body weight from day 60 to day 200. The results are shown in the figure below.

