

A patented* Grape Seed
Selected Proanthocyanidin
Phospholipid Complex

.....
Phytosome® improved
bioavailability

.....
Specifically developed for
cardiovascular protection

.....
Clinical and
pharmacological data
support its efficacy

.....
A safe product, devoid of
any side effect



Leucoselect®
Phytosome®

Grape seeds

■ **Antioxidant substances** such as polyphenols have been widely recognized to hinder degenerative processes that underlie chronic diseases. Polyphenols, commonly found in fruits and vegetables, are a key element of the Mediterranean diet and have long been known for their **capillary protective effects**. Their beneficial role in respect of **cardiovascular** system is well demonstrated by a lot of scientific studies and clinical trials.¹

In recent years, researches have focused specifically on the therapeutic potential of the **phenolic compounds** found in grapes. Interesting findings originating from epidemiology, in fact, had suggested that red wine (very rich in polyphenols) could exert a preventive action against the development of chronic diseases of the cardiovascular system, such as **atherosclerosis**, which is strictly related to oxidative damage to plasma lipoproteins.²

At least partially, this explains the so-called "French paradox", a term referring to the lower-than-expected incidence of cardiovascular diseases in France despite the high dietary saturated fat intake and the habit of smoking cigarettes.^{3,4}

Grape seed extracts have been demonstrated of particular clinical interest,⁵ due to the presence of small molecular size polyphenols, named **oligomeric procyanidins** (OPCs). A critical aspect is, grape seeds extracts have variable chemical compositions and polyphenols are known for their low and erratic bioavailability.⁶⁻⁸

A natural clinically-proven aid for cardiovascular protection

Leucoselect® is a grape seed extract with a well-defined chemical composition, which was completely elucidated by HPLC-UV, GPC and HPLC-TSP-MS as follows:⁹

- **15%** (+)-catechin, (-)-epicatechin
- **80%** (-)-epicatechin gallate, dimers, trimers, tetramers and their gallates
- **5%** pentamers, hexamers, heptamers and their gallates

This high content of **smaller size OPCs** is crucial for the **therapeutic activity**, being the absorption of procyanidins affected by molecular weight.¹⁰ Hence procyanidins of higher molecular weight are discarded in the production of Leucoselect®, allowing for the **concentration of the smaller pharmacologically active molecules** dimers, trimers, tetramers and their gallates.

To further improve their bioavailability, Leucoselect® has been **complexed** with soy phospholipids (1:3 w/w), thus obtaining **Leucoselect® Phytosome®**.

Its cardiovascular protecting activity is supported by **four clinical trials**,¹¹⁻¹⁴ both in normal and pathological conditions, and by **extensive pharmacological data**.¹⁵⁻²⁴

Clinical studies

The efficacy of Leucoselect® Phytosome® was verified at a dosage corresponding to 300 mg/day of procyanidins in four clinical trials. It was proven **effective in improving antioxidant defences** and **in counteracting the oxidative stress**, both in normal and in pathological circumstances characterized by an increase in oxidant generation and a decrease in antioxidant protection.

■ *Improvement of the total antioxidant capacity of plasma in healthy volunteers*¹¹

Leucoselect® Phytosome® was administered for 5 days to 20 young subjects in a single-blind randomized placebo-controlled crossover trial.

The product induced a significant increase of serum total antioxidant capacity (TRAP) assessed on day 1 and day 5, starting already from 30 min postdose with a further increase at 60 min postdose, in comparison with baseline values (chart 1). After a washout period of at least 2 weeks, the treatment was repeated with coherent results.

Antioxidant defenses protect low-density lipoproteins (LDLs) from oxidation by free radicals, a process associated with the initiation of atherosclerosis

■ *Improvement of plasma oxidative status in healthy volunteers after a fatty meal*¹²

The capacity of Leucoselect® Phytosome® to prevent the plasma oxidative stress after a fatty meal, rich in lipidic peroxides ("Milanese" steak and French fries), has been evaluated in 8 healthy volunteers. At the beginning of the trial the subjects received the lipidic peroxides rich meal and after a week the same meal and Leucoselect® Phytosome®.

The product was proven able to reduce the oxidative stress induced by the meal, providing a significant reduction of plasma postprandial lipid hydroperoxide concentration (chart 2) with an increase of TRAP and resistance of LDLs to oxidative modification.

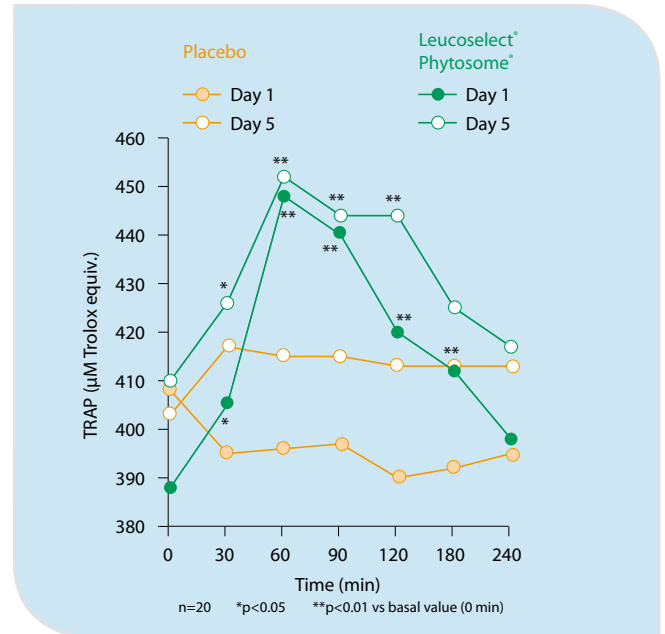


Chart 1: effect of Leucoselect® Phytosome® on TRAP in healthy volunteers

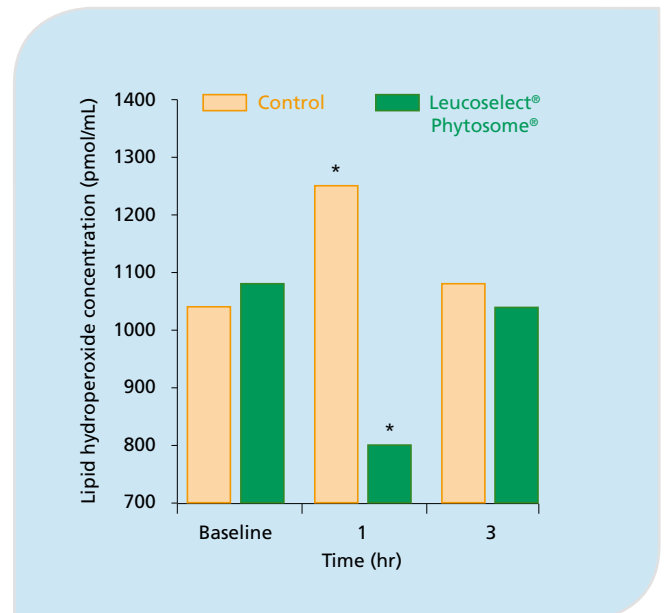


Chart 2: effect of Leucoselect® Phytosome® on mean plasma postprandial lipid hydroperoxide concentration

Leucoselect® Phytosome® is able to prevent plasma postprandial oxidative stress. It decreases the oxidants, increases the antioxidant levels in plasma and enhances the resistance of LDLs to oxidative modification.



■ **reduction of LDL susceptibility to oxidative stress in heavy smokers**¹³

Leucoselect® Phytosome® was administered for 4 weeks to 24 healthy male heavy smokers, aged 50 or more, in a randomized double-blind crossover trial. The product induced a significant improvement of LDL resistance to oxidation, as shown by lipid peroxidation parameters: thiobarbituric acid reactive substances concentration (TBARS, an index of lipid peroxidation and oxidative stress) was significantly reduced while the lag phase (an index of LDL resistance to oxidation) was prolonged, both in comparison with placebo and basal values (table 1).

Leucoselect® Phytosome® is endowed with a significant efficacy in a common model of oxidative stress as smoking.

Cigarette smoke contains carbon and oxygen-centered free radicals, which can directly initiate and propagate the process of lipid peroxidation

| | Placebo | | | Leucoselect® Phytosome® | | |
|--------------------------|-----------|-----------|-------|-------------------------|------------------------|--------------------|
| | basal | 4 weeks | Δ% | basal | 4 weeks | Δ% |
| TBARS (nmol/mg proteins) | 0.56±0.10 | 0.57±0.08 | +5.0 | 0.64±0.11 | 0.56±0.13 ⁺ | -14.7 [*] |
| Lag phase (min) | 59.0±13.0 | 57.7±9.8 | -0.13 | 52.9±7.6 | 61.1±15.6 ⁺ | +15.4 [*] |

⁺p<0.005 vs baseline

^{*}p<0.05, ^{*}p<0.005 vs placebo

Table 1: effect of Leucoselect® Phytosome® on LDL resistance to oxidation in heavy smokers

■ **improvement of oxidative stress in diabetic patients**¹⁴

Leucoselect® Phytosome® was administered for 4 weeks to 24 type 2 diabetic patients in a double blind crossover parallel study, significantly reducing urinary excretion of 8-epi-PGF_{2α} in comparison with placebo. Enhanced urinary excretion of 8-epi-PGF_{2α} is a marker of oxidative stress linked with increased formation of F₂ isoprostanes, non enzymatic products of arachidonic acid peroxidation.

Diabetes is a chronic pathological state associated with enhanced lipid peroxidation, microvascular complication, development of atherosclerosis and thromboembolic events

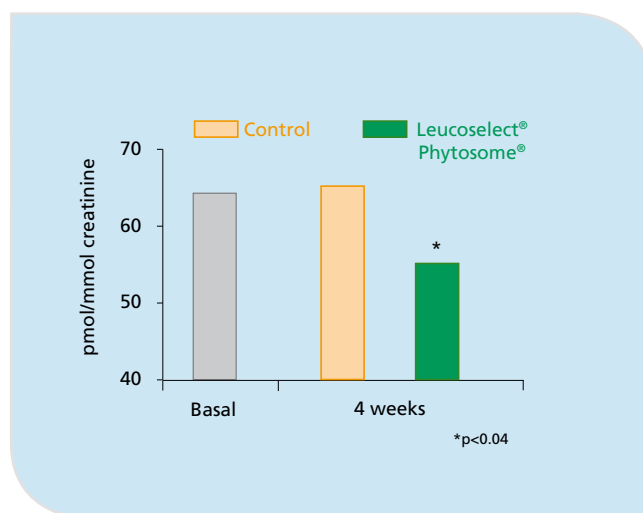


Chart 3: effect of Leucoselect® Phytosome® on urinary excretion of 8-iso-PGF_{2α} in diabetic patients

Pharmacology

The pharmacological profile of Leucoselect® Phytosome® has been defined by extensive *in vitro* and *in vivo* experimental studies. For the *in vitro* studies it has been used in the uncomplexed form.

■ ***in vitro***¹⁵⁻²¹

• **antioxidant activity**

Leucoselect® demonstrated its effective antioxidant capacity through different mechanisms: free radical scavenging activity, chelation of transition metals, inhibition of enzymes, quenching of singlet oxygen, sparing and regenerating effect on α-tocopherols.

• **cardiovascular protective activity**

Leucoselect® reduced ischemia/reperfusion injury concurrently stimulating prostacyclin release in the isolated rabbit heart, protected endothelial cells from peroxynitrite induced damage and modulated the endothelium-dependent NO release in human artery. Furthermore, Leucoselect® was proven effective on several enzymes involved in the degradation of the extravascular matrix.

in vivo

antioxidant activity²²

Leucoselect® Phytosome®, administered for 3 weeks at 2.4% concentration in a standard diet, increased TRAP in young and aged rats ($\Delta\%$ = +40 and +30) and physiological antioxidant defences of plasma.

antiatherosclerosis activity^{2,23,24}

Leucoselect® Phytosome®, administered at 2% concentration in a standard diet, was proven effective against mild and severe atherosclerosis.

Atherosclerotic aortic lesions developed in rabbits fed on a balanced 0.25% cholesterol-rich diet, while in the group supplemented with Leucoselect® Phytosome® a marked reduction of aortic lesions was observed and many animals showed lesion frequencies similar to the standard chow-fed group (fig.1 and table 2).

A significant thickening of the carotid, evaluated with the intima/media ratio, developed in rabbits fed on a balanced 1% cholesterol-rich diet. The administration of Leucoselect® Phytosome® (2%, 6 weeks) with the diet significantly reduced the thickness of the arterial wall in comparison with the hypercholesterolemic controls.

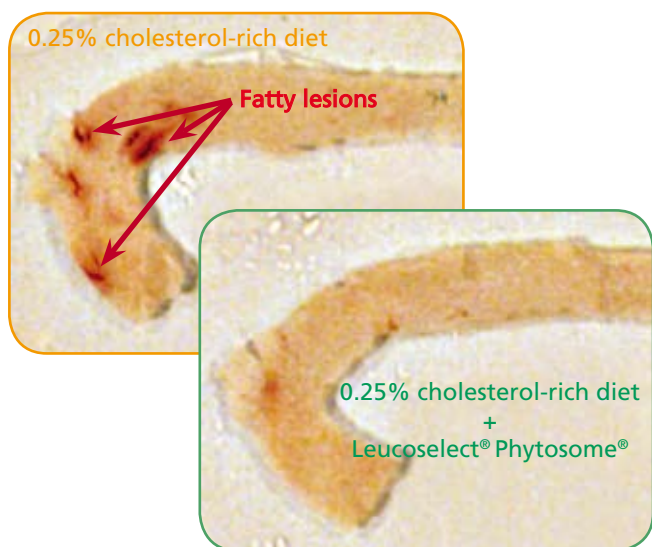


Fig. 1: effect of Leucoselect® Phytosome® on mild experimental atherosclerosis in rabbits

| Treatment | % coverage by lesion |
|--|----------------------|
| Standard chow-fed diet | <0.1 |
| 0.25% cholesterol-rich diet | 18.2±7.6 |
| 0.25% cholesterol-rich diet + 2% Leucoselect® Phytosome® | 3.0±1.9 |

Table 2: percentage coverage of aortic arch by fatty lesions in mild experimental atherosclerosis in rabbits

cardiovascular protective activity²²

Leucoselect® Phytosome®, administered for 3 weeks at 2.4% concentration in a standard diet, reduced ischemia/reperfusion induced damages in the heart of young and aged rats. The recovery of myocardial function, expressed by left ventricular developed pressure (LVDP), at the end of reperfusion was 93% and 74% of the preischemic values, respectively (chart 4). The protective effect on heart contractility was also strictly associated with a preserved coronary blood flow, expressed by the reduction of coronary perfusion pressure (CPP) close to the preischemic value both in young and aged rats (chart 5).

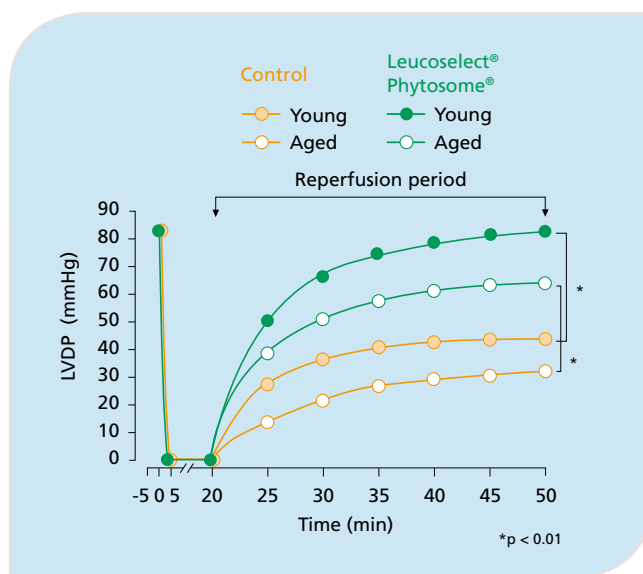


Chart 4: effect of Leucoselect® Phytosome® on left ventricular developed pressure

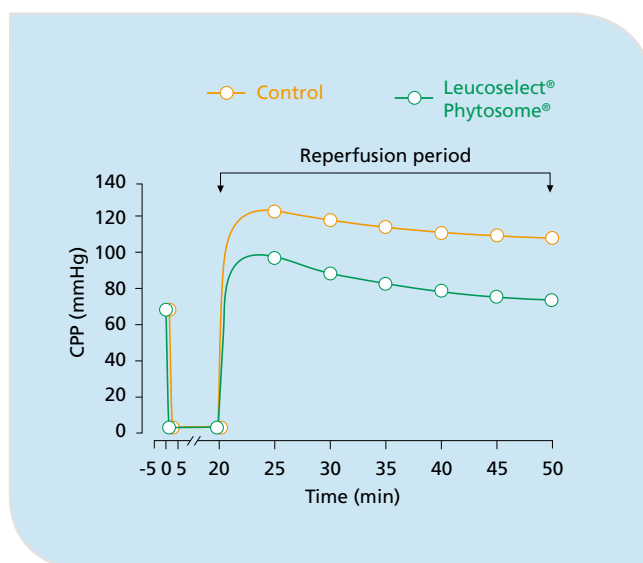


Chart 5: effect of Leucoselect® Phytosome® on coronary perfusion pressure in aged rats

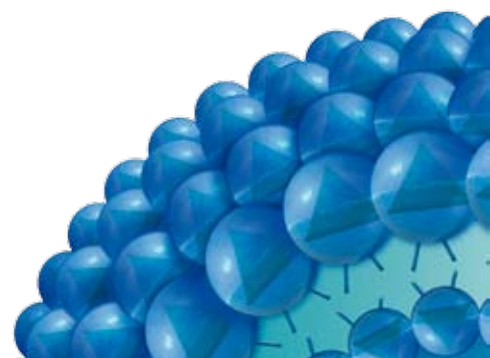
Conclusive remarks

Leucoselect® Phytosome® was proven able to reduce oxidative stress and to improve plasma antioxidant defences both in physiological and pathological conditions. The efficacy of Leucoselect® Phytosome® is guaranteed by its fully elucidated chemical composition and its standardized content of **smaller size OPCs**. The patented Phytosome® formulation further enhances OPCs bioavailability.

Hence it represents an effective and safe aid in the prevention of chronic diseases of the cardiovascular system.

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