**ANTIOXIDANT EFFECTS**

In this 10-week study, 80 male rats were treated with a liver-damaging chemical known as t-BHP (Tert-butyl hydroperoxide). Giving these rats access to Rooibos (instead of water) helped to protect the liver against structural, enzymatic and biochemical damage, and could even reverse some of the damage. These findings provide solid evidence that **Rooibos can improve liver function and protect the liver against oxidative damage.**

Ajuwon et al., 2013. Protective effects of rooibos (*Aspalathus linearis*) and/or red palm oil (*Elaeis guineensis*) supplementation on tert-butyl hydroperoxide-induced oxidative hepatotoxicity in Wistar rats. Evidence-based complementary and alternative medicine : eCAM, 2013. Available at: [http://dx.doi.org/10.1155/2013/984273](http://dx.doi.org/10.1155/2013/984273)

In the first study to examine the antioxidant activity of Rooibos on meat products, researchers found that **unfermented Rooibos increased the shelf-life of ostrich patties** by delaying the oxidative degradation of meat fat. Fermented Rooibos also slowed fat oxidation in ostrich salami. These promising preliminary results merit further studies into how the tea exerts its protective effect, and whether any long-term effects exist.


Researchers used *Caenorhabditis elegans*, a worm-like nematode, as a model to study the effect of Rooibos and aspalathin on oxidative stress. In high glucose environments Rooibos extracts and aspalathin caused the nematodes to live longer and reduced evidence of oxidative stress.


Oxidative stress can negatively affect mammalian sperm. Fermented and unfermented Rooibos significantly improved the number of sperm produced by male rats that had undergone artificially-induced oxidative stress. Rooibos also improved sperm motility, which measures how well sperm are able to swim towards an egg to fertilise it. In other words, **Rooibos may improve male fertility (sperm quality and function).**


Compared to rats that received only tap water, those that received Rooibos tea had **significantly less damage to their testicular tissue** after researchers injected the area with a chemical oxidative stressor. Oxidative stress is a prominent cause of defective sperm.

A human study with 15 healthy volunteers proved for the first time that the antioxidants in Rooibos are potent enough to **measurably elevate the antioxidant levels in blood**, thereby boosting the body’s internal defence systems against disease. The effect peaks about one hour after drinking 500 ml Rooibos tea.


A Japanese study showed that Rooibos could **reduce inflammation in rats with colitis** (open sores in the colon) via increased antioxidant activity with a consequent reduction in damage to DNA caused by oxidation. These researchers recommend Rooibos as a safe and useful way to reduce oxidative stress.


## Anti-diabetic Effects

Using a cell model (muscle cells) researchers have confirmed that unfermented rooibos extract is able to **alleviate the development of insulin resistance** and to improve the cells’ uptake of glucose. This means that Rooibos could play a key role in the prevention of diabetes.


Researchers found that aspalathin-enriched “green” Rooibos extract and aspalathin **decreased blood glucose levels**. They used *in vitro* and *in vivo* methods to obtain their results. Aspalathin, in combination with rutin, another Rooibos polyphenol, performed even better. This suggests that the polyphenols might interact to create a greater hypoglycaemic effect.


The results of this study strongly suggest that **aspalathin, a major polyphenol in Rooibos, has anti-diabetic potential**. The authors found that the compound affects the cellular signalling pathways involved in glucose metabolism, and that it reduces the expression of certain genes that code for liver enzymes involved in glucose and fat production. Mice were used as a model of Type 2 diabetes, along with cell lines.


According to this study, **aspalathin helped to maintain normal blood sugar levels** in mice with type 2 diabetes. Aspalathin also stimulates pancreatic beta-cells to secrete insulin and helps to improve impaired glucose tolerance in these animals.

CARDIOVASCULAR PROTECTION

Rooibos and its polyphenols aspalathin and nothofagin caused a four-fold reduction in the total steroids produced by an adrenal gland cell line. The tea especially reduced the amount of precursors of aldosterone, a blood pressure-related hormone, and cortisol, a stress hormone. Imbalances and elevated levels of adrenal hormones are associated with hypertension, cardiovascular disease and type 2 diabetes, so Rooibos may be considered as a potential therapy for these ailments.


Forty human volunteers consumed six cups of fermented Rooibos daily for six weeks, after which researchers assessed heart, liver and kidney function using various biochemical indicators. They found that the tea significantly reduced LDL-cholesterol, the “bad” cholesterol, and increased HDL-cholesterol, the “good” cholesterol. This is the first study to provide clinical evidence that regular Rooibos consumption improves blood lipid status. The study also found that the anti-oxidant activity of the tea could be relevant in reducing the risk of developing cardiovascular disease. More research is needed, but the results of this study are a promising start to confirm the health-promoting properties of Rooibos in people.


Researchers found that the hearts of rats who had consumed Rooibos extracts for seven weeks were protected against the effects of ischemia, or a restriction of blood supply, more so than if they had consumed regular Camellia sinensis tea. The researchers had artificially restricted and then restored blood supply to the rat hearts, thereby causing oxidative stress in the tissue. Rooibos seemed to protect against this injury and they suggested that this may be due to an inhibition of cell death by the flavonols present in the tea.


A South African study in humans showed that taking six cups of Rooibos every day for a period of six weeks significantly reduced several of the pertinent biomarkers associated with cardiovascular disease and protects the body against oxidative damage of blood lipids. The liver and kidney functions of the 40 participants were monitored and no adverse effects from taking six cups of rooibos per day were found.


Chrysoeriol, an antioxidant present at low levels in Rooibos, can prevent and treat vascular disease in humans. Chrysoeriol is able to inhibit the migration of smooth muscle cells inside the aorta, a key cause of atherosclerosis (narrowing or hardening of the arteries). The research was done on human aorta cells. Scientists therefore recommend the use of chrysoeriol to prevent and treat the repeated narrowing of blood vessels following coronary angioplasty. During angioplasty, a small balloon is used to open up a blocked or narrowed heart artery. (Note: Often only trace quantities of chrysoeriol are found in Rooibos.)

**IMMUNE-REGULATION**

Rooibos tea was found to affect the concentration of biomarkers for inflammation and immunity in whole blood cultures. These findings suggest that **Rooibos is able to modulate immune function in vitro**. Further in vivo studies could shed more light on whether Rooibos could be used as a dietary supplement to suppress or enhance immunity as needed.


**ANTII-OBESEITY EFFECTS**

This study suggests that daily consumption of Rooibos could aid the management of metabolic diseases and obesity. In mice that had high blood lipid levels, especially those that had consumed an unhealthy diet, **Rooibos was found to lower serum cholesterol, triglyceride and free fatty acid concentrations**. The tea also prevented the abnormal retention of lipids within liver cells, and it reduced the size and number of fat cells.


**ANTI-CANCER PROPERTIES**

Rooibos extracts were found to **reduce the number and size of chemically-induced oesophageal tumours** in rats. In fact, unfermented extracts reduced the average total papilloma size by 87%. The polyphenols present in the tea leaves are thought to be responsible for this anti-cancer effect.


**BIOAVAILABILITY & SAFETY**

Using urine samples from 12 healthy men who had consumed Rooibos, **researchers found that aspalathin and nothofagin, major Rooibos antioxidants, are metabolised in the body** so that it is easier for the body to excrete the metabolites. This means that the compounds are available for use by the body (bioavailability) and are not simply excreted in the same form that they are ingested.


Joint research between the Agricultural Research Council and the Medical Research Council were able to show that two Rooibos antioxidants – aspalathin and nothofagin – are changed by liver enzymes in vitro.


A study in Italy found flavonoid metabolites in the urine of ten human volunteers after they had drunk 500 ml green and fermented Rooibos. Most metabolites were excreted within five hours of tea consumption.

The metabolism of aspalathin was confirmed in humans in a collaborative study by researchers in the UK and Switzerland. They found metabolites of aspalathin in the urine of the study participants.


Other Research – Sensory, Industry & Agricultural Potential

The phenolic content of Rooibos is affected by seasonal production variations, quality grade and steam pasteurisation. Researchers found that grade A (the highest quality) samples contained a higher content of almost all phenolics. They also determined that steam pasteurisation decreased the content of the majority of phenolic compounds in a ‘cup-of-tea’ strength rooibos infusion.


Scientists have isolated and analysed a compound thought to contribute to the taste and mouthfeel of fermented Rooibos. The compound is known as Z-2-(β-D-glucopyranosyloxy)-3-phenylpropenoic acid (PPAG) and it has a slightly bitter to astringent taste. It was not always present in high enough quantities to detect in unfermented tea leaves, and this leads to large variation in the fermented plant material, infusions and food-grade extracts.


Researchers found substantial variation in the polyphenolic content and total antioxidant capacities of different production seasons and quality grades of Rooibos.


This article describes how a sensory wheel was developed to help standardise the terminology and quality of Rooibos tea. Using the wheel, Rooibos teas can now be thoroughly described in terms of taste, flavour and mouthfeel. As such, the “characteristic” Rooibos flavour is described as “a combination of honey, woody and herbal-floral notes, with a slightly sweet taste and subtle astringency”.


This study found that the total antioxidant capacity of infused Rooibos tea was slightly higher than that of Rooibos hot water extracts. The total polyphenol and aspalathin contents were equivalent, while the isoorientin and orientin contents of the infusion were found to be slightly higher than those of the extract. Hot water extracts are increasingly used as an ingredient in ready-to-drink beverages and a variety of food products.

Steam pasteurisation significantly reduces the amount of certain polyphenols in Rooibos, including the antioxidant aspalathin. It also affects the aroma and flavour of the tea, and decreases the astringency slightly. Koch et al., 2012. Impact of steam pasteurization on the sensory profile and phenolic composition of rooibos (Aspalathus linearis) herbal tea infusions. Food Research International. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0963996912004280

This review article summarises the scientific data available on the health effects of Rooibos, including the animal models used and whether the tea was fermented or unfermented. The long list includes activities against cholesterol, high blood sugar, fat cell development, oxidative stress, heart disease, inflammation, wrinkles, cancer, sun damage and liver damage. The paper also mentions that Rooibos is actually not a valuable source of nutrient minerals like Vitamin C and iron, as is sometimes claimed in promotional material. Joubert, E. & de Beer, D., 2011. Rooibos (Aspalathus linearis) beyond the farm gate: From herbal tea to potential phytopharmaceutical. South African Journal of Botany, 77(4), pp.869–886. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0254629911001086


Notes:

1. **In vitro** (Latin: in glass) studies are conducted in the laboratory, and commonly called "test tube experiments".
2. **In vivo** studies are conducted with living organisms in their normal intact state (such as animal studies or clinical trials).
3. **Ex vivo** studies are conducted on functional organs that have been removed from the intact organism (for example, studies on living cell lines).

July 2013, SA Rooibos Council (www.sarooibos.org.za)