NAQI®
SKIN CARE INNOVATORS
FOUNDATION

THERAPEUTIC MAGAZINE
ISSUE 3/2016

I Care Issue

ATHLETES CARE

about their game,
their skin,
their health,
their peace of mind...

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EDITOR'S LETTER

Are you ready for pollution? Are you ready for cold weather?

The NAQI Therapeutic Magazine covers the following two topics: Does air pollution negatively affect your skin and health? And do cold weather conditions damage your skin and muscles, resulting in poorer performances?

In part 1, we discuss the meaning of pollution and how we can solve skin problems with the latest generation of active ingredients, such as Ectoin. A randomized study discusses the efficiency of this new concept. This is followed by a skin solution for pollution, and the experience of an international ice hockey athlete, Mrs Glynis Barton, competing in the first women's national ice hockey competition in the Netherlands.

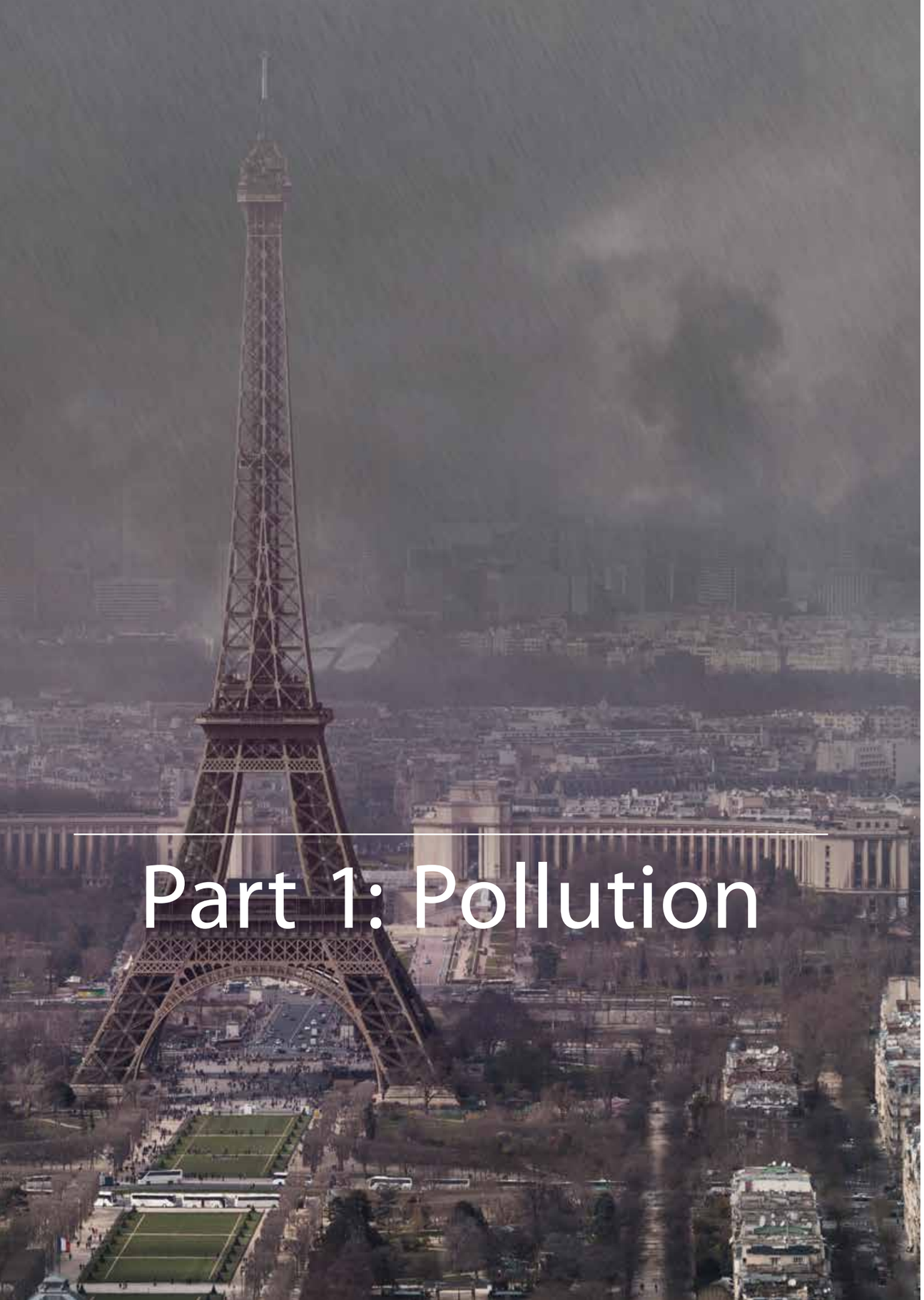
Part 2 starts with a scientific study on the trainability of cold-induced vasodilatation in fingers and toes. This is followed by physical therapy's perspective on whether the Hof method could be a viable alternative. What is the effect of cold on skin and muscles, and can it be solved by topical products? The cold also poses a positive challenge. Gertjan Verdickt runs the Ice Marathon for MS patients and explains how he prepares. Do we need to hydrate differently in the winter and summer?

We hope you will enjoy the new issue.

Edgard Geyskens

EDITOR

HYPOTHESIS: The hypothesis of the NAQI® Therapeutic Magazine is that the quality and the outcome of therapeutic care and sports performance will substantially increase if treatment is supported by skin therapy/care. The condition of the skin (ao scars, dry skin) can negatively influence therapeutic care and sports performance, even to a degree that skin care becomes a necessity before any other treatment.



Part 1: Pollution

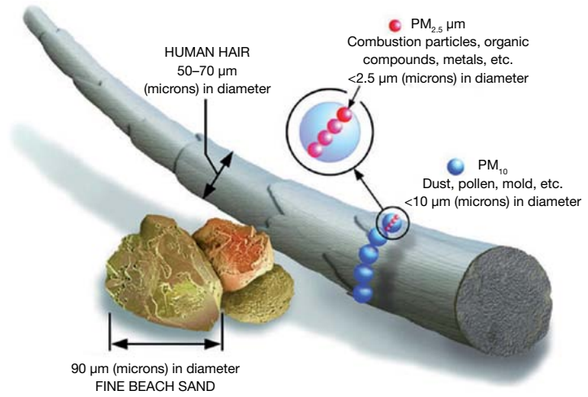
HOW DOES POLLUTION AFFECT US?

Air pollution (ap) is an important determinant of health and increasingly on the minds of many athletes and active people, especially those who exercise outdoors. Athletes take in 10 to 20 times as much air. As a physical therapist or coach, you can't deny the impact of ap on the physical conditions, the muscles and the heart rate and you are obliged to take these indicators into account in your treatment or training schedule. But on which level does ap harm , how can we measure it with the ap-hra (air pollution health risk assessment), what is impact of the particulates (pm's), etc. Below is a short introduction.

WHAT'S AIR POLLUTION[1]

Air pollution is the introduction of particulates, biological molecules, or other harmful materials into earth's atmosphere, causing adverse health effects. AP may come from anthropogenic or natural sources. The air pollutants often investigated in studies – particulate matter (PM), black carbon, ozone (O3), nitrogen dioxide (NO2), nitrogen oxides (NOx), sulphur dioxide (SO2), carbon monoxide, heavy metals, or black smoke – may be proxies for the air pollutant mixture. This issue is particularly relevant in relation to the health impact of exposure to PM in ambient air. PM originates from primary emissions (e.g. soot from combustion sources, sea salt, and soil from wind-driven resuspension) and formation of secondary particles in the atmosphere. PM may be characterized in terms of the mass concentration of particles smaller than 2.5 µm (PM2.5) or 10 µm (PM10), the number of particles (ultrafine), or the chemical composition (e.g. black carbon, organic compounds, and heavy metals). Figure 1 shows a schematic overview of the relative sizes of PM10 and PM2.5 in relation to a human hair and fine beach sand (US EPA, 2008).

Figure 1. Schematic overview of the relative size of particulate pollution, PM_{10} and PM_{25}

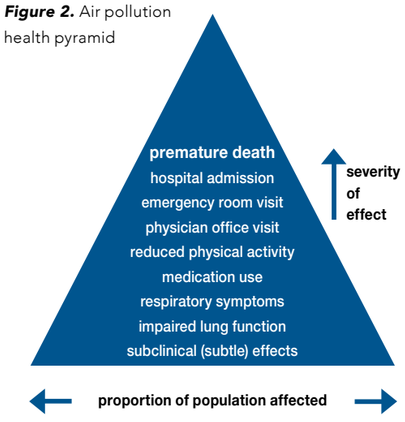


WHAT'S THE IMPACT OF PMPM ON HUMAN HEALTH

In the latest report by the WHO on the health risk assessment of air pollution, they mention the following: Numerous epidemiological studies have found an association between air pollution and a wide range of adverse health effects in the general population; the effects have ranged from subtle subclinical effects to premature death as shown in **Figure 2** (Samet & Krewski, 2007). Some groups – for example older adults, children, pregnant women, and people with an underlying disease, such as asthma – may be more at risk, and may develop more severe health effects more quickly when exposed to air pollution. In addition, certain groups may be exposed to higher levels of outdoor air pollution, e.g. outdoor athletes, people living near busy traffic routes, or those in specific occupational or socioeconomic groups (WHO Regional Office for Europe, 2005). Pollution in ambient air is generally a complex mixture. Consequently, the adverse health impacts observed in epidemiological studies and attributed to an individual air pollutant may actually be partly due to other pollutants in the mixture. Epidemiological and toxicological evidence shows that PM mass (PM2.5, PM10) comprises fractions with varying types and degrees of health effects (WHO Regional Office for Europe, 2013). Different particle sizes, composition, or characteristics can be related to specific emission sources better than other air pollutants and may therefore be considered a (more) suitable indicator. Thus, PM10 may be an appropriate indicator when considering the impact of resuspension of road dust, while black carbon is a more sensitive indicator for exhaust emissions from road traffic (Keuken et al., 2012). PM2.5 has been investigated in many epidemiological studies, and has been shown to be a robust indicator of risk associated with exposure to PM from diverse sources and in different environments (Lim et al., 2013). **Figure 3** shows the PM2.5 in 25 EU cities in comparison with the (AQG) Air Quality Guidelines

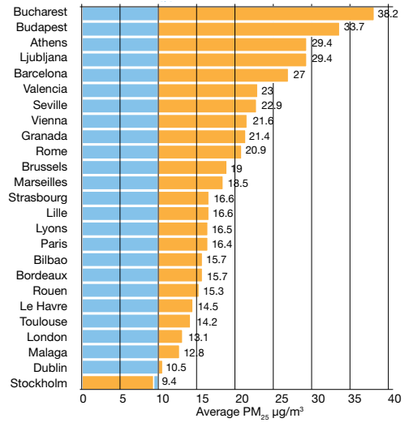
Pollutants can sail past nasal hairs, the body's first line of defence, and settle deep in athletes' lungs. Some remain there, causing irritation and inflammation. Others, so tiny they can bypass various bodily defences, migrate into the bloodstream. Blood vessels do not like those particulates. Dr D. Newby, a cardiology professor at the University of Edinburgh, did a kind of stress test of the blood vessels in the participants' forearms. They found that the vessels were abnormally dilated, meaning blood and oxygen could not flow easily to the muscles. At the same time, levels of tissue plasminogen activator, or tPA, a naturally occurring protein that dissolves blood clots, had fallen. Those are ideal conditions for a heart attack. A heart attack can start when arteries constrict and a clot forms. Without sufficient tPA, the clot is not dissolved, the artery is blocked, and the heart is damaged.

Figure 2. Air pollution health pyramid



Source: adapted from Samet & Krewski (2007), reproduced with the permission of Taylor & Francis Ltd.

Figure 3. Air Quality Guidelines.



WHAT'S THE IMPACT ON THE SKIN*

Drakaki et al. (2014) very clearly summarizes: The human skin, and mainly the upper layer of the epidermis, plays the role of a barrier, but is also one of the first and major targets of air pollutants. Air pollutants include those of environmental origin, as well as those of anthropic origin (Valacchi et al., 2012). Major air pollutants with effects on the skin include solar ultraviolet radiation (UVR), polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), nitrogen oxides (NOx), particulate matter (PM), and cigarette smoke. The actions of various air pollutants may be amplified in the presence of other air pollutants and with the interaction of UVR, and form major active components of the pro-oxidant smog (Baudouin et al., 2002; Katsouyanni, 2003; Kampa and Castanas, 2008). Depending on the nature of these pollutants and the integrity of the skin, the modes of the penetration of pollutants differ. Alterations that disturb the skin barrier function, in either stratum corneum lipid metabolism or protein components of the corneocytes, are involved in the development of various skin diseases. The protective ability of the skin is not unlimited, and problems arise when an abnormal exposure to environmental stressors exceeds the skin's normal defensive potential (Valacchi et al., 2012). Air pollutants may induce severe interference with the normal functioning of lipids, DNA, and/or proteins of the human skin via oxidative damage (Adelman et al., 1988; Karten et al., 1988; Halliwell and Gutteridge, 1989; Stadtman, 1992; Gaboran et al., 1993; Menzel, 1994; Ames et al., 1995; Valko et al., 2006; Kampa and Castanas, 2008), leading to skin aging, inflammatory or allergic conditions such as atopic dermatitis, psoriasis and acne, and skin cancer (Kohen, 1999; Baudouin et al., 2002).

HOW TO MEASURE THE HEALTH RISK ?

AP-HRA (air pollution health risk assessment) should be an ideal tool to take into consideration with the training schedule, rehab, or recovery programmes. An AP-HRA aims to estimate the risks of past, current, or future exposure to air pollution and of changes in exposure that may result from planned policies or other modifications of air quality (Department of Health, 2006; HIP, 2014). A health hazard can be defined as a source of risk to human health or wellbeing (Department of Health, 2006). A health risk assessment is the scientific evaluation of potential adverse health effects resulting from human exposure to the hazards of air pollution. An AP-HRA may be quantitative or qualitative; it generally assesses (i) the amount of air pollution present, i.e. pollutant concentrations, (ii) the amount of contact (exposure) of the targeted population, and (iii) how harmful the concentration is for human health, i.e. the resulting health risks to the exposed population (WHO, 2010).. The required input data for an AP-HRA (e.g. air pollution, baseline health statistics, Concentration-Response Functions of air pollutants) are not always available, and many risk assessments have to be based on estimates or judgements of some of the data inputs or characterizations. As a result, HRA outcomes generally have associated uncertainties, which should be characterized as far as possible (WHO, 2010). It should also be noted that AP-HRAs generally include only the subset of health impacts that can be quantified, and do not deal with other health effects for which no CRF is available. We are still in the take-off phase of the measurement of the AP-HRAs.

IS THE AP A DISASTER ?

It would be amiss to minimise or underestimate the adverse health effects of AP, with but there is no reason for panic. The international institutions and governments are conscious of the AP challenge. They implement a lot of new regulation to decrease AP, like the 2015 United Nations Climate Change Conference, COP 21 in Paris, France, with the global agreement on the reduction of climate change, and the New York agreement (adoptation within local legal systems) on Earth Day, 22 April 2016.

Otherwise there is a lot of fundamental and operation research related to AP. There are even solutions to prevent adverse health effects, and protect people from them. We are in the take-off phase and we must promote more fundamental and operational research.

RANDOMIZED STUDY DATA CONFIRM ANTIPOLLUTION ACTIVITY WITH ECTOIN®

BASED ON THE ARTICLE BY SILKE SCHAGEN, SABRINA OVERHAGEN, SUSANNE GRETHER-BECK, JEAN KRUTMANN, ANDREAS BILSTEIN[1] - BITOP[2]

ABSTRACT

It is known that air pollution may contribute to accelerated skin aging. The attention of skin care research related to the negative influences of air pollution on the skin is usually focused on particulate matter (PM10, PM2.5, PM1, PM.1, and smaller), which can be released from different sources, either occurring naturally or being human-made. Because of their size, these particles remain adhere to the skin very welland can be contaminated with toxic substances, such as polycyclic aromatic hydrocarbons (PAH). These PAHs, mainly produced by biomass burning, can cause oxidative stress to the skin and damage connective tissue and cellular proteins. Ectoin® is known to strengthen the skin's barrier function, to work against variable stressors, such as UVA/UVB radiation, IR-A, high-energy visible light, or allergens, and for its anti-inflammatory properties. This study demonstrates the protection and prevention capabilities of Ectoin® from air pollution (PAHs, PM2.5, PM1, PM and smaller).

INTRODUCTION

The WHO defines air pollution for two areas, indoor and outdoor. The contamination of the air is caused by chemical, physical, or biological agents that modify the natural characteristics of the atmosphere. Pollutants of major public health concern include particulate matter and gases such as carbon monoxide, ozone, nitrogen dioxide and sulphur dioxide[1].

Air pollution in the European metropolitan areas has decreased in recent years due to strict control measures, but is still high enough to exceed the limits in various cities many times a year. For a number of Asian (Karachi, New Delhi, Kathmandu, Bejing), Latin American (Lima, Arequipa), and African cities (Cairo), air pollution data is reported as very high, causing many related health issues. Even in the relatively cleaner cities of Europe or North America, where particulate matter (PM) levels are 3–5 times lower, substantial health effects can be observed[2].

Dust, soot and chemical substances, photochemically derived ozone, cigarette smoke, etc. consist of small particles. Particles can have different sizes; common classifications are PM10, PM2.5 , ultrafine particles (UP/UFP), and nanosize particles (UP or PM0.1). PM contains heavy metals, which can catalyze harmless substances into noxious agents. Ultrafine particles are carriers of ROS (reactive oxygen species) generating organic compounds. PM10 can penetrate into in human nasal cavity, PM2.5 in bronchi and pulmonary alveoli, ultrafine particles into the lung tissue and even into the bloodstream. Depending on the size and depth of penetration of the particles, the effects on health are different. Skin exposure to benzo[a]pyrene (BaP), a group

[1] Euro Cosmetics, 2016, 7-8 p.22-25

Special thanks to Mrs. Anne-Marie Stevens of Kreglinger Europe NV, Antwerp for all her support.

of compounds known as the polycyclic aromatic hydrocarbons (PAHs), can induce inflammatory diseases and skin cancer, which are both associated to oxidative stress. BaP and PM are known to bind with specificity to the aryl hydrocarbon receptor (AhR), modifying the expression of Cyp1A1 (Cytochrome P450, family 1, subfamily A, polypeptide-1) and the release of POMC (Pro-opiomelanocortin), MMP1 (Matrixmetallopeptidase-1) and IL-6 (Interleukin-6), resulting in inflammation, formation of dark spots, collagen breakdown, and wrinkles, which may induce accelerated skin aging[3, 4].

Carbon black particle exposure of lung epithelial cells seems to trigger a pathway at cell membrane level which increased expression of pro-inflammatory genes including ICAM-1 (Intercellular Adhesion Molecule-1), and is considered to play a critical role in the attachment and migration of immune and inflammatory cells to the airway mucosa[5].

In addition to the upper and lower respiratory tracks[6], the skin is especially exposed to air pollution, mainly to particulate matter, which has been shown to contribute to accelerated skin aging showing symptoms such as wrinkling, pigmentation, loss of elasticity, irritation and dryness, inflammation and allergic reactions, or even skin cancer or telangiectasia[7, 8].

*[2]**BITOP** is a German manufacturer, around the world recognized as an expert for the biotechnological production and development of high quality extremolytes, like Ectoin® and Glycoin® natural. Extremolytes are natural stress protection molecules found inside of microorganisms and plants, which thrive in extreme habitats. They repair and revitalize biological structures and thereof, and functions and protect them from damage and degeneration. These characteristics are directly transferable to skin care products with spectacular effects.*

For more information: www.bitop.de

Ectoin® is a safe and natural cosmetic active ingredient with cell protection properties. Ectoin® regulates the osmotic stress in extremophilic bacteria , and protects and stabilizes proteins, enzymes, nucleic acids, and cell membranes, when applied to human tissues. The skin barrier is stabilized and skin hydration restored. The increased degree of skin hydration is preserved for 7 days without further treatment[9, 10].

Various in vitro, in vivo studies and clinical trials confirm Ectoin® activity, with regard to protection of langerhans cells[11], protection from heat/IR-A, UVA/UVB[12, 13] and visible light[14], inflammation reduction[15,] and treatment of atopic dermatitis[16]. In different models, Ectoin® showed a reduction of PM-induced neutrophilic inflammation and effects on PM-induced exacerbation of allergen sensitization[5, 17, 18, 19].

This study will present Ectoin® data which show keratinocyte and skin protection against the damaging stress of air pollution. Ectoin® combines various types of well-established pollution-protection effects. Ectoin® is the only pollution protection agent that also reduces allergic reactions and skin aging induced by airborne allergens such as pollen.

METHODS AND RESULTS IN VITRO STUDY

Results of this study demonstrate that Ectoin protects the skin from pollution induced damage and aging. As already described POMC, MMP1 and Cyp1A1 expression can be activated by pollution particles[4].

For this in vitro study fresh human epidermal keratinocytes from female Asian and female Caucasian donors were used. Cells were untreated and pre-treated (24h) with 2mM Ectoin solution. After treatment, cells were stressed with fine and ultrafine carbon black particles and different types of exhaust particles (Tab. 1).

Then, POMC, MMP1 and Cyp1A1 mRNA expression were measured in keratinocytes by using real time PCR.

This results in figure 1 show that fine and ultrafine carbon black particles and diesel particulate matter induced POMC, MMP1 and Cyp1A1 mRNA. POMC is known for melanogenesis stimulation in human melanocytes and to cause dark spot formations. MMPs play a role in collagenase and elastase breakdown in the extracellular matrix of the dermis. Cyp1A1 mRNA expression induces oxidative stress in human skin which results in inflammation or cancer.

Ectoin protected keratinocytes significantly down regulated PM induced overexpression of marker genes. POMC mRNA expression is down regulated in all tested cases by 100% or close to 100%. In addition, Ectoin also protected from upregulation of MMP1 and Cyp1A1.

Tab.1: Different types and sizes of particulate matter were used:

Particulate Matter	Type	Name	Size
Both particles are much smaller than $PM_{2.5}$ and PM_1	ultrafine particles	Printex 90	0.014µm particle diameter
	fine particles	Huber 990	0.26µm particle diameter
Both materials contain PAHs and heavy metals as well as PM_{10}, $PM_{2.5}$ and PM_1	diesel engine exhaust soot from heavy duty equipment engines	SRM 1650	–
	diesel soot from a forklift engine	SRM 2975	–

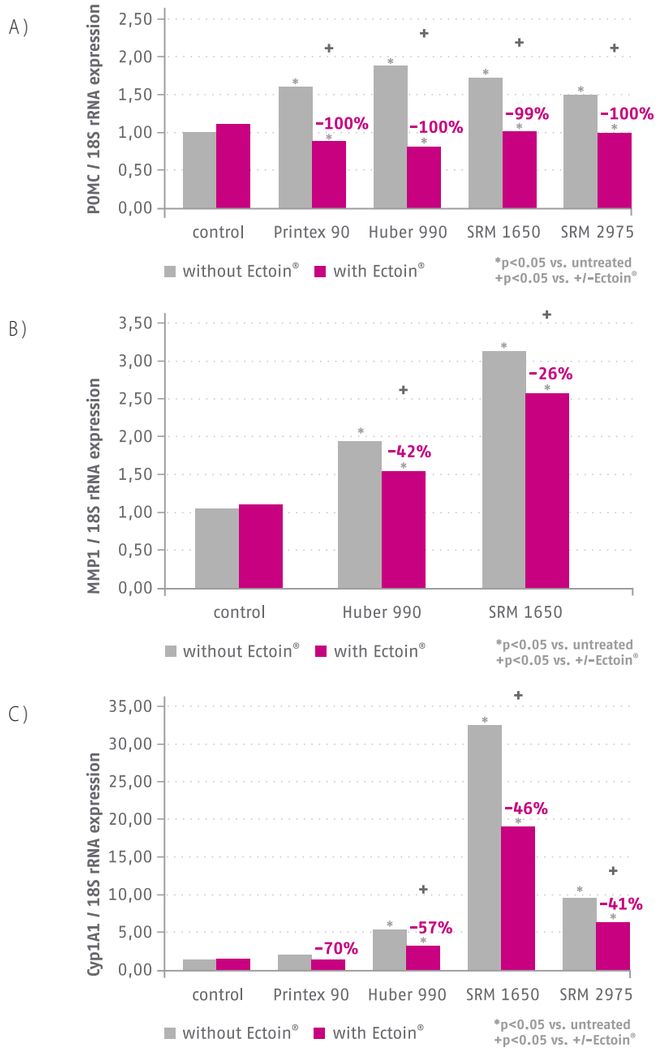


***Figure 1**: Up-regulation of A) POMC, B) MMP1 and C) Cyp1A1 mRNA expression in primary human keratinocytes (Asian and Caucasian) by sub toxic amounts of ultrafine and fine carbon black particles and by two different types of exhaust particulates. 18S ribosomal RNA (rRNA) was used as a housekeeping gene to normalize mRNA expression. A) Ectoin treatment downregulates PM induced POMC overexpression. The remaining response is calculated by setting the pollution induced effect equal 100%. B, C) Ectoin reduces MMP1 and Cyp1A1 up-regulation and protects keratinocytes also from fine carbon black particle and diesel particulate matter*

IN VIVO STUDY

To test in vivo the anti-pollution activity and efficacy of a cream containing Ection®, a specialized dermatological center in Germany was chosen. The study design (placebo controlled, randomized, double blind) is the most innovative, standardized in vivo pollution test method currently available. Six volunteers applied the cream with placebo or 1% Ection® on volar forearm for 5 days twice daily. Furthermore, areas on the volar forearm were tested untreated and unstressed (negative control) as well as untreated and stressed with cigarette smoke (positive control). On day 5, skin was stressed with cigarette smoke as pollutant for 15 minutes to induce oxidative stress to the skin in a standardized pollution chamber system.

The protective activity of the test products was evaluated by analysis of barrier lipid oxidization levels (measured by malondialdehyde, MDA) of ex vivo samples from the skin surface. MDA results from lipid peroxidation of polyunsaturated fatty acids and is one of the reactive electrophile species that cause toxic stress in skin cells and can therefore be used as a marker for air pollution induced damage.

5 Days of Ection® containing cream application showed a positive effect. The pollution induced MDA overexpression was 48% lower compared to placebo and 47% lower compared to untreated but challenged control. A clear trend towards efficacy in protection against pollution induced skin damage was observable. Ection® is a full spectrum pollution protection active ingredient. After only 5 days of application, the pollution induced lipid peroxidation in the skin was remarkably reduced by 48%. Ection®is capable to shield the skin from the whole spectrum of air pollution components including metals and PAHs as well as all particle siwes (PM2.5, PM1, PM 0.1 and smaller) - for a complete and instant protection and prevention of pollution induced damage and skin aging.

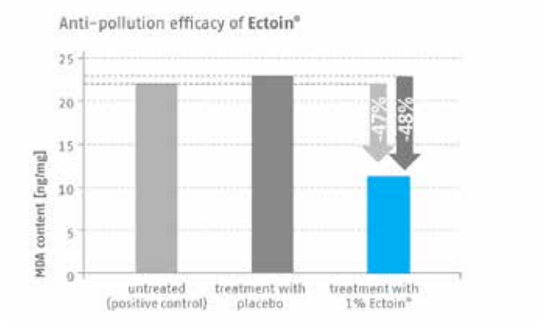


Figure 2: *Cigarette smoke application on the volar forearm – after only 5 days of application with 1% Ectoin® the pollution induced MDA content in the skin was reduced by 48% compared to the placebo treated areas. A strong anti-oxidant (gold standard) was capable to reduce the pollution-induced MDA content in the skin by 27% (data not shown).*

SUMMARY AND DISCUSSION

Ection® strengthens the skin barrier function and is capable to shield the skin from the whole spectrum of air pollution and allergens. This includes clouding metals and PAHs as well as all particle sizes (PM2.5 , PM1 , PM0.1 and smaller) for a complete and instant protection and prevention of pollution induced damage and skin aging.

Ection® forms a hydrocomplex around skin cells, thus protects the skin at cellular level. Particle induced damage will be prevented and repaired. Air pollution induced expression of POMC, MMP1 and Cyp1A1 in skin cells (Asian and Caucasian) were significantly reduced by Ection® treatment. The protective activity of Ection® containing cream was evaluated in vivo by analysis of barrier lipid oxidization levels from the skin surface. In conclusion, Ection® skincare products protect against pollution.

IS POLLUTION AGING YOUR SKIN?

— Interview by Frank Van Laeken, sports journalist & writer —

You dress appropriately for the weather whenever you play an outdoor sport or go for a walk. You protect almost everything – except your face, which remains exposed, even though it is the most sensitive skin on your body. This has consequences, including the redness, cracks and irritations that are so common in winter. It was therefore crucial to develop protection for the face.

But it's not just the cold that we need to protect our skin against. Air pollution is also a problem. It is not only the result of industrial and biological processes: some substances become toxic due to a chemical reaction with UV rays and heat, which also causes ozone and smog. The sun is also a form of pollution. Due to the degradation of the ozone layer caused by CFKs – chemical substances which used to be used in fridges but are now forbidden – more sunlight can penetrate the atmosphere.

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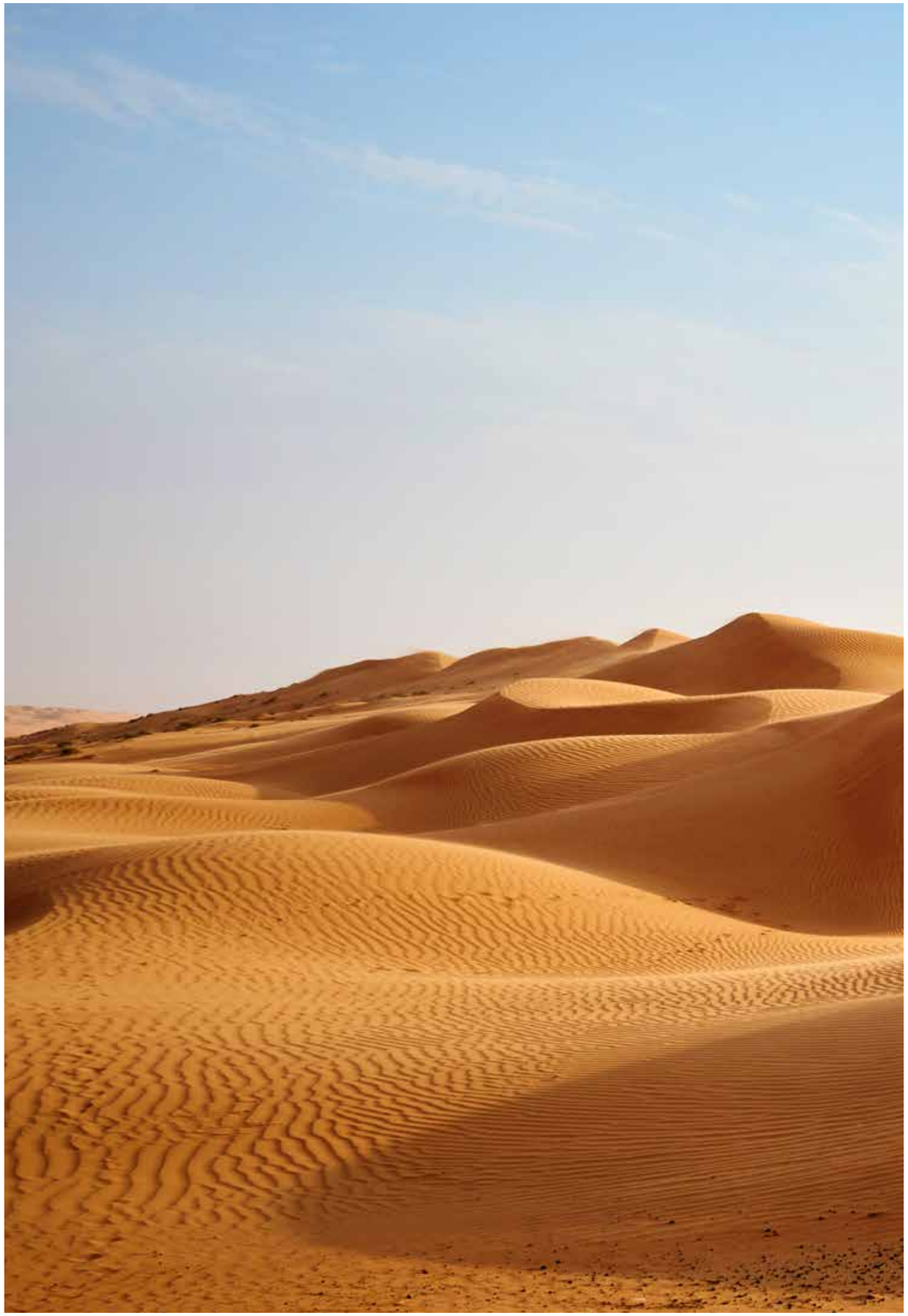


EXTREME CIRCUMSTANCES

The top layer of our skin fulfils an important task as it acts as a barrier. It is also the first in line of attack from air pollution. Pollutants seriously disrupt normal skin functions by releasing free radicals. A free radical is an atom that is missing one or more electrons. These unstable atoms react with other cells, disrupting them in the process. These reactions can cause a great deal of harm, sabotaging the cell nucleus and damaging DNA. Cell division will then produce inferior cells that do not function properly. Some may even go on to form tumours. Antioxidants, such as vitamin E and C, can limit damage as they attack free radicals.

Premature ageing is one of the effects of pollution. The visible effects include pigmentation marks and/or wrinkles. Just consider what most people living in the countryside used to look like. They already looked old by the time they were forty. For a long time, people thought that red cheeks were the result of healthy outdoor living, but nothing could be further from the truth. This redness was simply skin irritation. You can still see this in people who spend their working lives outdoors, such as builders. They are constantly exposed to the elements, and sometimes have to work outdoors in extreme weather conditions.

We have only been looking at the effect of pollution on our skin for about the past five years. At first, people used antioxidants on their own, but they did not offer any real protection to prevent the release of free radicals. If you spend a long time in a polluted environment, you must clean your skin thoroughly in order to remove the tiny particles of pollution sticking to the skin. People think that a quick shower is enough, but this is not true. You must cleanse your skin thoroughly using water and a mild cleanser, or the effects of pollution will accumulate.

EXTREMOPHILES TO THE RESCUE

Extremophiles are micro-organisms that live in inhospitable areas such as the poles, salt lakes and deserts. They produce ‘ectoin’, a protective substance. This is a 100 percent natural ingredient that stops and prevents cell damage, allowing stressed, irritated or ageing skin to repair itself and regenerate.

Ectoin® is currently produced using bacterial milks. Micro-organisms can be cultivated in a salty environment (15-20% salt), where they survive by producing ectoin. When the salt concentration drops (to 3%), they release ectoin, which is then separated and purified. It now appears that this substance has many more properties and much more potential than was previously thought. Originally it was used only as protection against extreme cold and heat. Ectoin® has a physical effect and prevents the release of free radicals. It reduces premature skin ageing that manifests mainly as premature wrinkling in European skin and in pigmentation problems in Black and Asian skin types. This extraordinary, versatile substance is used in creams and eye and nose drops. The disadvantage is that it is also an expensive raw material. It was subjected to a long test phase and cannot be produced in large amounts. It is produced in grams, not kilograms.

To take optimal care of your skin, it is best to use a cream containing Ectoin® regularly. The product must be allowed to absorb into the skin for ten minutes as it contains water, which must be allowed to evaporate. Tests have shown that this cream improves circulation. It also prevents pollutants from penetrating the skin and damaging it. The release of free radicals is reduced after only five days. It therefore provides active protection.
Daily skin care can no longer be seen as a superfluous luxury. It is best to apply cream to your skin, not just first thing in the morning, or when you are exercising outdoors, but also when you are walking in the street or on the beach.

5 TIPS FROM GLYNIS BARTON

— Interview by Frank Van Laeken, sports journalist & writer —

GLYNIS BARTON (27) IS MARKETING MANAGER AT RUNNERS' LAB & INTERNATIONAL ICE HOCKEY PLAYER, LIVING IN MAASMECHELEN, BELGIUM FOR 7 YEARS. GLYNIS PLAYS IN THE NATIONAL DUTCH WOMEN'S ICE HOCKEY TEAM AND HAS BEEN PART OF THE SELECTION SINCE SHE WAS 16. SHE COMPETED IN THE ICE HOCKEY WC IN GANGNEUNG, SOUTH KOREA IN APRIL 2017 (THE 2018 WINTER OLYMPICS WILL ALSO BE HELD AT THIS LOCATION) SHE PLAYS IN THE 1ST DIVISION DUTCH LEAGUE WITH MEN, SHE IS THE DUTCH CHAMPION IN ICE CROSS DOWNHILL (RED BULL CRASHED ICE) AND HAS COMPETED IN RACES IN QUEBEC, CANADA AND JYVÄSKYLÄ, FINLAND.

1. FORGET THAT LONG, HOT SHOWER AFTER EXERCISE

Playing an outdoor sport is hard on your face, especially in cold weather. You sweat, get dirt in your pores, and a fine layer of salt accumulates on your skin. Usually you do not have a cleansing product within reach to tackle this problem immediately. Also, being a tough athlete, you don't want to bother about this anyway, she joked. It's OK to just rinse the dirt from your face with ordinary tap water. But forget all about that long, hot shower. You know the situation: you come in from the cold into a hot changing room and stay under a hot shower for as long as possible. But this is bad for your skin because it strips it of its natural protective oils. It's better to just have a short shower and rinse afterwards with cold water.

People sometimes think that the cold must be a problem when you are playing ice hockey, but this is not the case. The physical exertion is intense, you are sweating all the time and you don't feel the cold in your face. Mother Nature feels much harsher to me whenever I go mountain biking or trail running. I used to take really long hot showers, just to relax and chill out. But I have become more aware. Nowadays, I usually start off with a tepid shower, turn up the temperature to hot and finish off with a cold blast to close my pores. No matter how hard you have just been playing, you still love your creature comforts.

2. TIE A SCARF IN FRONT OF YOUR MOUTH AND NOSE

Tie a multifunctional scarf across your nose and mouth to protect as much of your face as possible against extreme cold. We call this a Buff after the famous brand name. It's nice and tight and you feel the cold less. And you can also fold it to make a hat.

3. LET YOUR BODY GET ACCLIMATISED

If you have just got back from exercising in the cold, it is important to let your body reach the right temperature indoors. It has to acclimatise. Take off your cold clothes as quickly as possible and stretch or do some gentle exercises for your core stability. Don't forget that you may have been outdoors in temperatures of minus five and are about to take a shower in water heated to thirty-five degrees: that's a temperature difference of almost 40 degrees!

4. DRINK ENOUGH WATER

Even when it's cold you still have to keep drinking water to stay hydrated. When playing a sport, you should drink half a litre of water for each hour of exertion. Don't drink water too hot or too cold because your body will then have to work harder to process it. Room temperature water is fine.

5. USE A PROTECTIVE CREAM

Your skin must be able to breathe. I never used to think about this when I was younger, but keeping my skin looking even is becoming more important to me as I get older. Most hydrating creams are not suitable for outdoor activities. They freeze outdoors, which is bad for your pores. A layer of Vaseline will also block your pores and make your skin greasy, preventing you from sweating normally. A protective layer of NAQI® VISAGE SUPREME N°4 does not feel greasy, will not produce a burning sensation and afterwards you will have fewer red blotches in your face, thanks to the nourishing ingredients.

I CARE

INTENSIVE CARE & PROTECTION

Outdoor Face Protection

DERMATOLOGICALLY TESTED

Natural all-year-round face protection

Formulated with Ectoin®, a natural protective substance that helps organisms survive extreme climatological stress. NAQI® Visage Supreme N°4 provides the ultimate all-year-round skin protection for people with an active lifestyle. NAQI® Visage Supreme N°4 covers the skin with a protective film to keep it safe from environmental stress, heat, cold, wind and UV radiation. It prevents and reduces skin redness and feeling of taut skin. NAQI® Visage Supreme N°4 intensively hydrates dry and sensitive skin.

Use: Apply before outdoors activity. Use it as often as required. Gently massage into the skin.

Intensive Face Care

DERMATOLOGICALLY TESTED

Immediate skin booster for a radiant youthful-looking skin

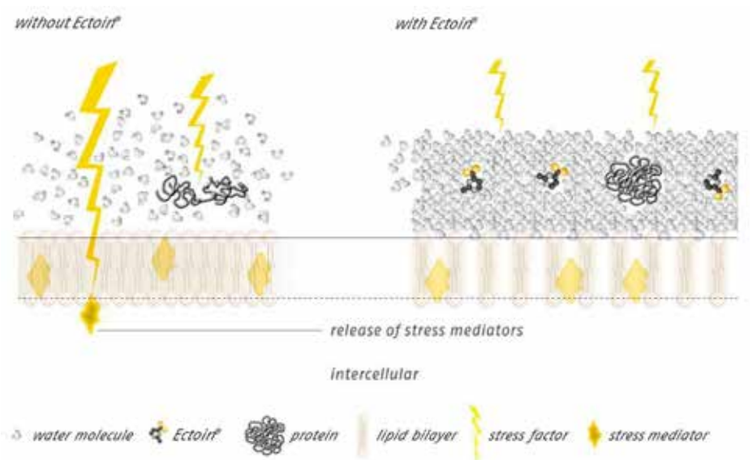
Formulated with Ectoin® and Aquaxyl™ to protect the skin against the visible signs of environmental stress and skin ageing. Strengthens the skin's natural resistance. Provides an immediate and long-lasting boost of the extracellular dermal matrix for a fuller, smoother and softer skin. Prevents and reduces skin redness and a taut feeling. Hydrates and strengthens the skin intensively on all skin levels and skin types.

Use : apply daily in the morning and evening. Gently massage into the skin.

What is better than repairing damage and fighting free radicals? Preventing it! Ectoin® acts BEFORE free radicals are formed. It reduces and inhibits the oxidative stress impact on the cell and,at the same time, enhances the cellfunctions. As a result the cell transforms into a better general condition.

The anti-pollution activity of Ectoin® is specifically based on:

- the improvement of the skin barrier (less particles can penetrated into the skin)
- the improvement of the cell-functions (skin is in a better condition and less sensitive to stress factors; skin´s own immune system is enhanced e.g. LangerhansCells.)
- the reduction and prevention of cellular and extracellular particle (PM and UP) stress due to the protection shells around the cells.



Source: BITOP: surface of cell membranes (extracellular space) with and without Ectoin®

Part 2: Cold Protection

TRAINABILITY OF COLD INDUCED VASODILATATION IN FINGERS & TOES

HEIN A. M. DAANEN - JENS KOEDAM - STEPHEN S. CHEUNG

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ABSTRACT

Subjects that repeatedly have to expose the extremities to cold may benefit from a high peripheral temperature to maintain dexterity and tissue integrity. Therefore, we investigated if repeated immersions of a hand and a foot in cold water resulted in increased skin temperatures. Nine male and seven female subjects (mean 20.4; SD 2.2 years) immersed their right (trained) hand and foot simultaneously in 8C water, 30 min daily for 15 days. During the pre and post-test (days 1 and 15, respectively) the left (untrained) hand and foot were immersed as well. Pain, tactile sensitivity and skin temperatures were measured every day. Mean (SD) toe temperature of the trained foot increased from 9.49C (0.89) to 10.03C (1.38) ($p<0.05$). The trained hand, however, showed a drop in mean finger temperature from 9.28C (0.54) to 8.91C (0.44) ($p<0.001$) and the number of cold induced vasodilation (CIVD) reactions decreased from 52% during the first test to 24% during the last test. No significant differences occurred in the untrained extremities. Pain diminished over time and tactile sensitivity decreased with skin temperature. The combination of less CIVD responses in the fingers after training, reduced finger skin temperatures in subjects that did show CIVD and the reduced pain and tactile sensitivity over time may lead to an increased risk for finger cold injuries. It is concluded that repeated cold exposure of the fingers does not lead to favorable adaptations, but may instead increase the injury risk.

INTRODUCTION

When humans are exposed to cold, information from skin temperature sensors and blood temperature sensors in the hypothalamus activates the sympathetic nervous system, leading to skin vasoconstriction and reduced heat loss. The downside of this mechanism is that the blood flow in the fingers and toes may become so low that tissue integrity is at stake (Wilson and Goldman 1970). Fortunately, at extremity skin temperatures below about 15C a sudden periodic vasodilatation is often observed, first described by Lewis (1930). The most likely mechanism for this vasodilatation is the muscular wall of the arterio-venous anastomoses in the fingers and toes which cannot maintain vascular tone when cooled (Daanen 2003). The opening of these vessels lead to increased blood flow and, indirectly, increased local skin temperatures. Regardless of the underlying mechanisms, this cold induced vasodilatation (CIVD) response is often considered as a protective mechanism against local cold injuries (Daanen 2003; Wilson and Goldman 1970). Indeed, it has been shown that subjects with a reduced CIVD response have a higher risk of frostbite (Daanen and Van Der Struijs 2005). Therefore, it may be desirable for subjects working in the cold to have a fast CIVD response of high magnitude, leading to research into how to manipulate and possibly enhance CIVD.

The idea of using repeated local cold exposure as a training stimulus for increased CIVD comes from population cross-sectional studies. These studies showed that natives of circumpolar environments (e.g., Inuits and Sami) exhibit a higher mean finger temperature compared to people who live in a more temperate climate when exposed to cold (Krog et al. 1960; Miller and Irving 1962). An enhanced CIVD reaction was also observed in fishermen compared to a control group less regularly exposed to cold (Krog et al. 1960). Nelms and Soper (1962) found that fish filleters, who are exposed to local cold only, also showed a significant earlier CIVD reaction compared to the control group. However, the possibility of self-selection for these particular occupations should not be excluded. The effects of repeated cold exposure on CIVD in field studies show ambiguous results. Some studies found a lowered mean finger temperature after a 2-week Arctic expedition, which may indicate a higher risk for cold injuries (Livingstone 1976). On the other hand, Purkayastha et al. (1992) observed higher finger temperatures in Indian soldiers after a 7-week expedition to the Arctic environment.

In all reported lab studies on trainability, only either the hand or the foot was exposed to cold. Three studies were identified in which the foot was trained (Reynolds et al. 2007; Savourey 1996; Yoshimura 1960). The study of Reynolds et al. (2007) observed no differences, the other two studies observed higher mean foot temperatures after repeated immersion. For hand immersion, most studies showed no training effect (Eagen 1966; Geurts et al. 2006a; Glaser and Whittow 1957; O'Brien 2005), three studies showed a negative training effect (Daanen et al. 2007; Geurts et al. 2005a;Mekjavic et al. 2008) and only two studies showed positive effects (Adams and Smith 1962; Geurts et al. 2006b). In summary, it seems that training of the foot is more successful than training of the hands or fingers. CIVD of the fingers is generally much more pronounced than CIVDof the toes (Cheung andMekjavic 2007; Van Der Struijs et al. 2008) and there may be more scope for trainability in the toes than in the fingers.

Therefore, a study was performed in which the CIVD trainability was investigated for fingers and toes. This was done by tracking thermal responses of the fingers and toes over 15 days of repeated local immersion in 8C water. In line with the general picture from the existing literature, we hypothesized that toe CIVD would show more improvement than finger CIVD following repeated immersions.

METHODS

SUBJECTS: Eighteen students volunteered for participation in this study. During the first day, two subjects indicated that they could not tolerate the cold water during immersion of the hands and feet and were withdrawn. The remaining 16 subjects, nine males and seven females, participated until the end. The subjects had a mean (SD) age of 20.4 (2.2) years, mean (SD) height of 177.7 (1.1) cm, and mean (SD) body mass of 71.5 (12.4) kg. One subject was left-handed, 15 were right-handed and all were non-smokers. The subjects followed a protocol approved by the Human Ethics Committee of the TNO. All subjects were informed about the potential risks and discomforts of the study and gave their written informed consent to participate. All subjects were medically screened for cardiovascular diseases and Raynauds syndrome.

PROTOCOL: After entering the room (ambient temperature 20–24C, relative humidity 30–70%), the subject sat down on a chair. The subjects wore shoes, socks, trousers or shorts and a shirt (one single layer of clothing). For the first 10 min, the subjects rested while the measurement equipment was attached to the body by the researcher. Thermistors at the fingers were taped just lateral of the nail bed, since the reproducibility of skin temperature is better in the nail bed (O'Brien 2005). The thermistors for the toes were taped at the 'toe pad' since Reynolds et al. (2007) found a highly variable CIVD response at the nailbed of the toes. Therefore we chose for the toe pad, which is the common position in most previous research, so that comparison to previous studies is enabled (e.g. Van Der Struijs et al. 2008). Five minutes prior to immersion of the hand and foot in cold water, the subjects immersed their hand and foot in water of 34–36C to create similar starting conditions for every subject. The hand was positioned at the level of the heart, while the foot was placed in a water tank located on the floor. The hand as well as the foot made no contact with the bottom of the water tanks, because of a water-permeable mesh (3mesh, Muller Textil GmbH, Wiehl, Germany) that was lying at the bottom of the water tanks.

After 5 min in warm water the subject put the right hand (up to the ulnar and radial styloids) and foot (up to the malleolus) for 30 min into cold stirred tap water of 8C. The immersion baths were placed next to the warm water baths. The hand and the foot were immersed simultaneously. Every 5 min, starting at minute five, tactile sensitivity of the tip of the index finger was tested with Semmes–Weinstein monofilaments. Directly after the Semmes–Weinstein test, the subjects used the nonimmersed hand to fill in a pain score for their hand as well as foot. After 30 min of cold immersion, the hand and foot were taken out of the water tanks and patted dry with a towel. The temperature measurements ended 5 min later. This protocol was repeated over 15 days, 5 days per week. Day 1 was the pre-test and day 15 the post-test session. There were 2 days between the pre-test and the second immersion. Between day 14 and the post-test, the subjects had one day off. The left, non-acclimatized hand and foot were immersed at day 1 (pre-test) and 15 (post-test) as well, before or after (counterbalanced) the immersion of the right hand and foot.

MATERIALS: The hand immersion bath had a dimension of 49.5 (l) 9 29 (w) 9 13 (h) cm, and the foot water bath had a dimension of 46 (l) 9 36 (w) 9 22.5 (h) cm. To minimize the heat loss or heat gain of the water in the baths, they were insulated with polystyrene. The temperature was controlled within 1C using a thermostat bath (TLC 15, PM Tamson Instruments, Bleiswijk, The Netherlands).
Finger and toe temperatures were continuously monitored using thermistors (type P-8432, ICBT, Tokyo, Japan) attached to the skin by one layer of Leukoplast tape (BSN medical & GmbH & Co.KG, D-22771, Hamburg, Germany) and connected to a Mobi8 data acquisition system (TMS International BV, Oldenzaal, The Netherlands). The temperature of the fingers and toes was sampled every second. The lowest value over the 30 min immersion interval was defined as the minimum temperature (Tmin). The mean (Tmean) and maximum (Tmax) temperatures were calculated over the 5- to 30-min interval. CIVD reactions were defined as a continuous rise of at least 1C. To exclude minor fluctuations, we averaged the values over a period 20 s before and 20 s after the measurement for all temperatures. When the rise was<1C, the response was counted as 'No CIVD', when it was 1C or more it was counted as a CIVD response. The onset time is the time in seconds from start of the immersion until the start of a continuous increase of temperature of at least 1C. Tpeak is the temperature at the peak of the first CIVD wave. The CIVD analysis was completely automated to exclude human subjectivity.

Pain was assessed every 5 min using a 0–10 visual analog scale (VAS) Numeric Pain Distress scale. Tactile sensitivity at the tip of the index finger was assessed using Semmes–Weinstein monofilaments (Bell-Krotoski and Tomancik 1987). The subjects turned the hand under water every 5 min for about 10 s to enable determination of tactile sensitivity.

STATISTICAL ANALYSIS: Since most studies have limited statistical power, we included 16 subjects in the study. Based on finger pad temperatures in the study of O'Brien (2005), differences in onset time of 25 s and differences in peak temperature of 1.5C can be detected. We measured all fingers and toes because prevalence of a CIVD in a single finger or toe shows considerable variability (Cheung and Mekjavic 2007; Mekjavic et al. 2008; Reynolds et al. 2007).
Statistical analyses were performed using Statistica (Statsoft 2008). Data for skin temperature, pain and tactile sensitivity were compared using a two-way (condition 9 time) factorial analysis of variance (ANOVA), with finger and toe temperatures statistically treated as independent. CIVD parameters between pre- and post-test were identified using a paired t test. Differences in the number of CIVD reactions between pre- and post-test were analyzed non-parametrically. The results are expressed as means (SD), and significance was accepted as $p<0.05$.

RESULTS

The finger and toe skin temperatures averaged over all fingers and toes during the days of immersion are shown in **Fig. 1**. Finger skin temperature essentially remains constant; toe skin temperature shows an increase. During the last 2 days a drop in toe and finger skin temperature was noticed. Cold induced vasodilation parameters of the pre- and post-test are shown in **Table 1**. Due to technical problems with the attachment of the sensors to the skin, there were several drop-outs randomly divided over the subjects during the first day. While the untrained extremities did not change in temperature after 15 days of immersion, the trained extremities did change. The number of CIVD reactions with at least one wave dropped significantly in trained fingers after 15 days of cold water immersion from 52 to 24% ($p<0.01$) while it remained unchanged in the untrained fingers (39 vs. 46%). The onset times of CIVD were widely spread and did not display significant differences; neither did the peak of the CIVD wave. While the trained fingers showed a significant decrease in temperature (for Tmean, Tmin and Tmax, $p<0.001$) during the posttest, the trained toes showed an increase in temperature during the post-test (Tmean and Tmin, $p<0.05$; Tmax, $p<0.01$,). Finger skin temperatures were significantly lower for the thumb ($p<0.05$), index finger ($p<0.05$), middle finger ($p<0.05$), ring finger ($p<0.01$) and little finger ($p<0.001$) during day 15 as compared to day 1. Toe temperatures were higher for the middle ($p<0.05$), fourth ($p<0.01$) and little toe ($p<0.05$) and not significantly different between day 1 and day 15 for the big toe and the index toe.

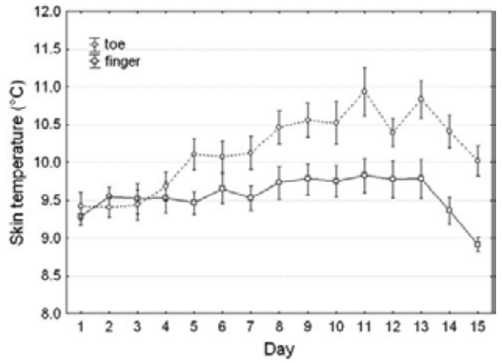


***Figure 1**: Finger and toe skin temperatures (C) averaged over minutes 5–30 and over all digits during immersion in 8C water for 15 consecutive days. Vertical bars denote the standard error of the mean.*

Table 1 Comparison between pre- and post-test for CIVD parameters

	Pre-test				Post-test			
	Fingers		Toes		Fingers		Toes	
	Trained	Untrained	Trained	Untrained	Trained	Untrained	Trained	Untrained
N	73	64	63	68	79	80	79	79
#CIVD	38 = 52%	25 = 39%	28 = 44%	30 = 44%	19 = 24%$^{\Delta}$	37 = 46%	23 = 29%	30 = 38%
Onset time (s)	676 (462)	629 (456)	766 (292)	763 (349)	716 (407)	629 (471)	735 (338)	741 (419)
T_{peak} (°C)	10.54 (0.69)	11.88 (2.07)	11.17 (0.99)	12.64 (1.81)	10.27 (0.79)	11.48 (1.90)	11.85 (2.05)	12.60 (2.35)
T_{mean} (°C)	9.28 (0.54)	9.41 (1.03)	9.49 (0.89)	9.73 (1.04)	8.91 (0.44)*	9.55 (1.10)	10.03 (1.38)†	9.96 (1.23)
T_{min} (°C)	8.69 (0.32)	8.69 (0.41)	8.81 (0.72)	8.88 (0.70)	8.48 (0.24)*	8.72 (0.45)	9.15 (0.89)†	8.97 (0.78)
T_{max} (°C)	10.21 (0.91)	10.49 (1.89)	10.85 (1.23)	11.54 (1.76)	9.63 (0.86)*	10.72 (2.13)	11.68 (2.16)$^{\Delta}$	11.92 (2.23)

N is the number of experimental datasets. The maximum is 16 subjects × 5 toes/fingers = 80. Mainly in the pre-test, several measurements had to be disregarded since the sensors became detached from the skin. #CIVD reactions stand for the number of experimental datasets with at least one CIVD reaction. Values are mean (SD)

* Significantly different from pre-test values ($p < 0.001$)

$^{\Delta}$ Significantly different from pre-test values ($p < 0.01$)

† Significantly different from pre-test values ($p < 0.05$)

Pain in the trained hand and foot decreased over time, as can be clearly seen in **Fig. 2**. This graph displays the average pain experienced during cold water immersion each of the 15 days. Pain in the hand dropped from 4.5 (1.8) at day 1 to 2.9 (1.9) at day 15 ($p<0.001$). Pain in the foot dropped from 4.6 (1.7) to 2.3 (1.8) ($p<0.001$). After day 4, there was no further significant drop in pain.

Pain was significantly less during post-test compared to the pre-test **(Table 2).** This is true for hand as well as foot and trained side as well as the untrained side. Because the scores of the trained and untrained hand at day 1 were equal (no significant change between these scores), the comparison between the scores at day 15 show significantly less pain in the trained hand, compared to the untrained hand at day 15. The same is true for foot, but a note has to be made here, because pain in the trained foot at day 1 was already significantly lower compared to the pain in the untrained foot ($p<0.05$).

Tactile sensitivity of the index finger did not change significantly over 15 days, but was related to the skin temperature of the index finger. **Figure 3** shows the relationship between index finger skin temperature and tactile sensitivity. For a mean (SD) skin temperature of 8.78C (0.35) only a thick filament (4.08 g) could be detected, whereas for an index finger skin temperature of 10.35C (1.83) even thin filaments of 2.44 g could be detected.

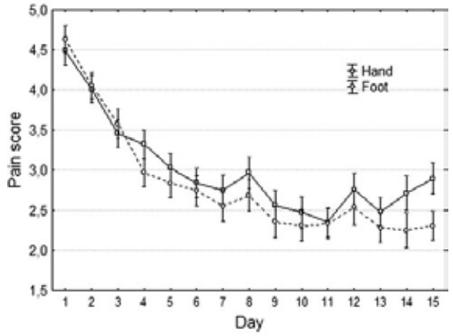


***Figure 2**: Average pain score and standard error of the mean of the trained hand and foot during immersion over 15 days. Note that at day 1 and 15 the immersion sequence of the extremities was counterbalanced*

Table 2 Pre- (day 1) and post-test (day 15) pain scores (SD)

Pain	Day 1	Day 15
Trained hand	4.5 (1.8)	2.9 (1.9)*
Untrained hand	4.8 (1.8)	3.9 (2.2)*
Trained foot	4.6 (1.7)	2.3 (1.8)*
Untrained foot	5.1 (1.7)	4.2 (2.1)*

* Significantly different from day 1 values ($p < 0.001$)

DISCUSSION

The main objective of this study was to investigate the effect of repeated local cold exposure on thermal responses in both the fingers and toes. Furthermore, we looked at the influence of local cold acclimation to pain and tactile sensitivity. Fifteen days of immersing the right hand and foot simultaneously in cold water for 30 min produced somewhat contradictory responses in the fingers versus the toes. Namely, the incidences of CIVD in toes pre- and postacclimation were not different, from 44% of the possible events pre-acclimation to 29% post-acclimation. However, the Tmean, Tmin, and Tmax increased post-acclimation, especially in the third, fourth, and fifth toes; although significant, the magnitude of the changes in our study is small, at<1C on average. Our data, combined with the positive training effect for toes observed by Yoshimura (1960) and Savourey (1996), seem to suggest that toe blood flow is trainable, albeit modestly. To date, only Reynolds et al. (2007) observed no changes in a similar study.

In contrast, the fingers proved unresponsive to repeated cold exposures, and indeed the thermal response may have degraded. The number of CIVD reactions in the fingers dropped significantly from 54 to 24%, post-acclimation, as did the finger skin temperature parameters. Less subjects showed CIVD post-acclimation and the subjects that still had CIVD showed it to a lesser extent. Results in the literature are conflicting, but the majority of studies observe no effect or a detrimental effect of repeated cold exposure to finger skin temperature. The decrease of CIVD reactions and temperature in fingers are in line with previous findings by Mekjavic et al. (2008), who found similar results of these parameters after

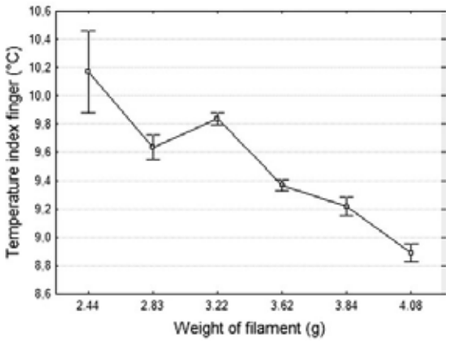


***Figure 3**: Relation between index finger skin temperature and tactile sensitivity. Tactile sensitivity is expressed as the weight of the Semmes–Weinstein filament. Data for this figure included all measurements over the 15 days of temperature and sensitivity (trained as well as untrained index finger). Vertical bars denote the standard error of the mean.*

The decrease in finger skin temperature due to training was mainly observed during the last 2 days. This drop in finger and toe temperature during the last 2 days (Fig. 1) may be related to the ambient temperature outside of the building that was about 16C during days 14 and 15 and 18–22C in the preceding days (meteorological data from Schiphol airport that is in close vicinity to the measurement location). The lower ambient temperature may have caused a reduction in the thermal state of the body prior to the experiment. Controlling the temperature of the experimental room and immersing the extremities in warm water (35C) for 5 min prior to the cold water immersion with the intention to create a stable thermal condition for the subjects may have been insufficient to eliminate the effect of the external ambient temperature on the thermal status of the body. On the other hand, it may simply be that the changes during the last 2 days reflect real changes due to cold training that may only take effect following prolonged and repeated exposures. The ambient temperature was identical at day 1 and day 15 (16C); therefore, a fair comparison can be made between the pre- and post-test.

The decrease in finger skin temperature and increase in toe skin temperature during the CIVD training period of 15 days may be partly attributed to anatomical differences. The feet have a smaller surface area to volume ratio than the hands (68 vs. 104 m-1 for men; Tikuisis et al. 2001), which leads to slower cooling of the feet as compared to the hands. This may be the reason that CIVD is less pronounced in the feet than in the hands (Van Der Struijs et al. 2008). Therefore, it may be more effective to enhance vasoconstrictory tone and the sensitivity of local blood vessels for cold in the fingers as opposed to the toes to maintain the overall thermal status of the body. These changes may have taken place over the 15 days of investigation. Another explanation may be that since the toes are more prone to cold injuries than fingers (Daanen and Van Der Struijs 2005), it is more important to maintain tissue integrity in the toes and thus enhance local blood flow there.

The observed changes in finger and toe temperatures after 15 days of cold water immersion in our study are not likely to be of central origin. When sympathetic outflow would have increased, both fingers and toes would have shown vasoconstriction. Therefore, a peripheral mechanism should be held responsible for the observed changes, such as an increased sensitivity to cold at the fingers leading to vasoconstriction and a decreased sensitivity to cold at the toes leading to a reduction in vasoconstrictory tone.

Pain during immersion decreased significantly during the 15 days of local cold exposure. This is true for both feet and hands and for the trained and untrained side. Figure 2 clearly shows that the greatest decline in pain occurs in the first few days, independently of possible adaptations in skin temperature. The decrease of pain in time corresponds to previous observations (Geurts et al. 2006a; Sawada et al. 2000). The relative increase in pain during days 8 and 12 may be explained by the fact that these measurement days were relatively often on Mondays, and the 2-day weekend break from cold exposure may have reduced pain resistance. Because pain can be seen as a warning signal of the body for extreme cold, some researchers claim that a decrease in finger temperature, in combination with a decrease in pain due to training, lead to a habituation effect (Geurts et al. 2006a; Sawada et al. 2000). When people experience less pain after a few days of repeated cold exposure it is not expected that they adjust their behavior to their real thermal status, which increases the risk of cold injuries.

Previous studies reported that tactile sensitivity was unaffected when measured before and after repeated cold exposure (Geurts et al. 2006a, b). Unlike those studies, tactile sensitivity in this study was measured while the hand remained immersed in cold water, such that no rewarming due to removal from the cold exposure occurred. Our results clearly show that a lower skin temperature leads to a decreased tactile sensitivity. This is in line with a deterioration of tactile sensitivity as a result of decreased skin temperature found by Gescheider et al. (1997), Green et al. (1979) and Daanen (2009).

For the untrained extremities no significant differences were detected in our study, so it can be concluded that the observed differences in finger and toe skin temperature must reflect local effects of repeated immersion. If there would have been a change in central drive due to repeated immersion, changes in both the trained and untrained extremities should have been observed. Sympathetic activity is the central drive that is generally considered to play a major role in the control of CIVD (Daanen 2003). The sympathetic nerves innervate the strong muscular wall of the arterio-venous anastomoses that are abundantly present at CIVD locations. Sympathetic activation thus leads to vasoconstriction and a reduced CIVD response (Daanen 2003). The absence of any change in the nontrained fingers and toes indicate that the sympathetic activity is probably unaltered due to training.

In summary, sixteen subjects simultaneously exposed a hand and foot to 8C water for 30 min daily for a period of 15 consecutive days excluding weekends. The toe temperatures showed a small increase after 15 days, while the finger temperatures dropped, as well as the number of CIVD responses in the finger. Therefore, the risk for cold injuries may increase in trained fingers, also because pain sensation gradually decreased so that the warning system becomes less alert. We, therefore, do not recommend repeated cold water immersion of the hands as a method for preventing cold injuries.

CAN YOU BEAT THE COLD?

Winter is coming, and so are the winter sports. Ice skating, skiing, ski jumping, and ice hockey are popular sports. Plus, there are several more extreme cold sports, like running the ice marathon. But is the cold weather a threat to the body? Can athletes train their bodies to better cope with the cold? Daanen, Koedam, & Cheung investigated the trainability of the foot and fingers against cold temperatures.

They tested 16 participants with a 30-minute immersion of the fingers and a foot in cold water (8°C). The temperature of the foot and fingers will decrease and the expectation is that the extremities show a cold-induced vasodilatation (CIVD). This means that the body shows a response to the cold in the form of vasodilatation, which induces a higher temperature. However, they found a different response in the foot and fingers. The foot showed a slight increase in temperature due to CIVD, which is a moderate effect. The fingers, however, showed a decrease of temperature, thus a lack of CIVD. This is an unwanted adaptation and can pose risks. The researchers state:

"The risk for cold injuries may increase in trained fingers, partially because pain sensation gradually decreases, so that the warning system becomes less alert."

So, there is an increased chance for cold injuries, such as tissue damage, and the sensitivity of the fingers decreases as the temperature decreases, which can be problematic if the athlete's performance depends on it. This is not desirable, so athletes should prepare themselves.

Tim Laagland

MAGAZINE BOARD MEMBER

THE ICEMAN

However, in the Netherlands lives a man named Wim Hof, better known as the Iceman. He is famous for being able to withstand the cold for an incredible amount of time, without a decrease of body temperature. One of his greatest achievements is spending two hours in a tank filled with ice and ice-cold water. What is his secret? Cold training in combination with breathing techniques and meditation.

BREATHING TECHNIQUE

His breathing technique is characterized by inhaling very deeply and exhaling smoothly. After thirty rounds of focused breathing, the next inhale only takes place when the body signals the need for new oxygen. Hof stated that, "Not exhaling completely will leave a residual level of oxygen in the lungs". These rounds are repeated several times. This breathing technique boosts the oxygen level in blood, which can have several positive effects, like decreasing the lactate level.

MEDITATION

The autonomic nervous system normally works unconsciously. However, with the right mindset, it is possible to have control over the autonomic nervous system. The goal of the meditation is to bring the body into an active state and control the fight or flight response. In a study done by Kox et al. (2012), Wim Hof was injected with the E. coli bacteria. The results showed that the number of inflammatory signals were half those of 112 other participants. But, maybe he is the only one capable of doing this? In 2014, the study was repeated with 24 people, 12 of whom received training from Wim Hof (Kox et al., 2014). This research showed the same result. It is impossible to describe here how to practice the meditation technique that is now known as the "Wim Hof method".

COLD TRAINING

When somebody is exposed to cold, they start to shiver and their skin forms goose bumps. When being exposed for too long, the skin will damage or the body may even become super-cooled. In Wim Hof's method, gradually exposing your body to cold temperatures will allow you to withstand the cold. Normally, the body will supercool in ice water after thirty minutes; the world record is almost two hours achieved by Wim Hof. Groothuis et al. (2010) found that Wim Hof's metabolism increased by 300%, which induced a temperature increase. This resulted in a constant temperature of 37°C during the attempt in which he did not supercool, nor did he experience any tissue damage.

EXERCISE IN THE COLD

A couple of remarks must be made here. In these examples, the subjects were not exercising, so no heat was generated. However, athletes are exercising. Secondly, the temperature can differ. Cold water (8°C) or air (-20°C) can have differing effects on the skin. Thirdly, athletes are most likely to protect themselves with protective gear like gloves or thermal shirts.

Let's take the ice marathon runner, for example; he wears special clothes and gloves to protect himself from the cold. Otherwise, the cold air could damage his skin. This sounds very logical and the research conducted by Daanen et al. supports the hypothesis that a runner cannot train his/her fingers to get used to the cold. But it may be possible using the Wim Hof method. However, it is always better to be safe than sorry, so it is a good idea to wear gloves. But what about other parts of the body where the skin is exposed to cold air, like the face?

PROTECTION

When conditions are harsh and there is no real need to train outside, it might be better to train indoors on a treadmill or a roller. When you do go outside, wear a three-layer outfit. Wear gloves, and since most heat is lost through the head, wear a good cap. Additionally, you can use special hand and toe warmers. Next, protect the bare skin that is exposed to the outside air, like the ears, lips and face. This magazine covers a few of our protection products, such as the NAQI® Face Protector.

CONCLUSION

There is material for debate on whether athletes can train their bodies to adapt to the cold. Based on the research discussed, it is not useful to train the fingers by immersing them in cold water. It might be profitable to train using the Wim Hof method based on breathing techniques, meditation, and cold training. In sport settings, there is a small chance for cold injuries, like tissue damage. When there is a risk, it is always better to be safe than sorry, so protect the body wearing a three-layer outfit, gloves, and a cap. You can also use NAQI® products to protect your bare skin.

Preparation	Protection
Prepare yourself for exercising in the cold.	*Protect yourself for exercising in the cold.*
Do not train your feet and fingers by immersing them in cold water.	*Ask yourself if training outside is necessary*
Try the breathing technique, meditation and cold training	*Wear a three layer outfit*
	Wear gloves and a cap
	Use toe- and handwarmers
	Protect the ears, face and lips with NAQI® products

HOW TO COPE WITH COLD?

— Interview by Wesley Muyldermans, sports journalist & writer—

WHAT EFFECT DOES COLD HAVE ON THE BODY?

Our body wants to maintain a constant temperature (homoeotherm). Vital organs, such as our hearts and stomachs, need this to function properly. Our skin has sensitive cold receptors that can detect a sharp drop in skin temperature and pass on this information to the brain. They emit more pulses when cooling down than when warming up and they are also more numerous than heat receptors. Cold receptors are also known as Krause's corpuscles. They can detect cold because they react to tissue shrinkage caused by a drop in temperature. When it's cold, the blood vessels in the skin contract and blood flow to the surface of our bodies drops. Heat has the opposite effect, as everything opens up to release the excess body heat.

Greet Claes

MAGAZINE BOARD MEMBER

DOES COLD HAVE THE SAME EFFECT ON THE MUSCLES?

Whenever we are engaged in intense physical activity, the blood flows quicker through our body and warms up our muscles. If circulation drops, our muscles will cool down automatically. But to be able to start exercising, the muscles must already be warmed up. This implies a sort of contradiction.

WHAT PROPERTIES ARE ESSENTIAL TO AN ANTI-COLD PRODUCT?

These products must be oil-based and definitely non-occlusive. They must certainly not contain water because you always lose 25% more warmth in water. You can think of it as follows. Imagine that you are sitting outside, in a pavement café. It's 25 degrees and you are only wearing a T-shirt. Well, that's no problem whatsoever. But try taking a 25 degree bath and you won't stay in it for long! This is why swimmers need extra protection, as they lose much more body heat than other sportspersons. They need good protection against the cold, or their performance will suffer badly.

DOES YOUR SKIN NEED DIFFERENT PROTECTION AT DIFFERENT AGES?

In principle, everyone needs the same protection. But the older you are, the slower your skin adapts to the ambient temperature. This does not mean that older skin requires different or fewer protection products. On the contrary, it actually requires a little bit extra protection. What you see happening is that people use warming products when it is cold, but you should avoid doing this with children. It is also true that cold hnds and feet are often age and gender related.

ARE SOME PARTS OF THE BODY MORE VULNERABLE TO COLD THAN OTHERS?

Our extremities – the parts of our bodies that stick out from the rest – cool down the quickest. Everyone has cold hands or feet sometimes. There is the least circulation in these parts of the body and they are the quickest to take on the ambient temperature. It is extremely important to protect the face. Most people wear the right clothes, but their face is often left exposed. What's more, approximately 40% of the body's temperature is lost via the head and neck.

ARE THERE THINGS THAT SPORTSPERSONS AND THEIR TRAINERS SHOULD PAY EXTRA ATTENTION TO IN ORDER TO BE BETTER PREPARED FOR THE COLD?

One very common mistake is to use warming products without a protective film. The product will open the blood vessels to improve blood circulation. But if you do not apply protection it will have the opposite effect and you will be colder outdoors that if you had not used any product in the first place. Using a warming product this way will work against the body's own natural mechanism. Choose a warming product that reduces heat dissipation without causing an occlusive effect. Apply the product – for example to your hands, legs and feet – preferably while these parts of the body are still warm. This will keep your temperature more constant, as once you are cold, the damage has already been done.

Training schedules often contain blocks of training in the cold in order to adapt to low temperatures. However, a recent study which tested immersing hands in cold water, showed that no such adaptation takes place. However, it is necessary to note here that this test involved cold water (and we know the effects of water), so it would be a good idea to conduct this test in cold air. We should also remember that the study involved a person immersing their hands in cold water, without exerting themselves physically. Engaging in intensive exercise at low temperatures is a different situation altogether, as this stimulates the circulation.

WARMING UP: EMPIRICAL RESEARCH

GREET CLAES

For certain complaints or treatments, therapists and sports people need extra warming up.NAQI® has developed specific warming products for this purpose. The lack of scientific research into the effectiveness of warming products has been the subject of many discussions. The most important counter-arguments are that warming lotions may cause vasodilatation, which takes blood away from the muscles, and that their active ingredients do not penetrate through to the muscle. NAQI® warming products merit important consideration in treatments and contribute to the quality of the care provided as we will illustrate here.

EMPIRICAL RESEARCH

PROTOCOL

Sixteen male volunteers were treated with a neutral massage lotion (LO* = NAQI® Massage Lotion Sport) and a Warming Massage Lotion (MP = NAQI® Massage Lotion Plus) on their thighs. Four massage techniques were applied: effleurage (EF), petrissage (PE), tapotement movements (HA), and to rub (IN). The temperature of the skin and of the muscle tissue at a depth of 1.5 cm were measured before the massage, immediately after the massage, and five minutes after the massage. * Lotion is an oil in water-based product that provides no cold protection.

DATA

- SKIN TEMPERATURE

Tables 1 and 2 show the evolution of the skin temperature. We see that a massage with a neutral lotion (LO) leads to a drop in skin temperature. This drop is only corrected through the tapotement massage. When using a warming lotion (MP), there is an immediate increase in temperature, which increases even further after five minutes. Rubbing in using a warming hydrogel (WU = oil-free lotion) or warming lotion (MP) first results in a slight drop,followed by an increase in temperature five minutes later.

- TISSUE TEMPERATURE

Tables 3 and 4 illustrate the evolution of the temperature of the muscle tissue. Massage with a neutral lotion creates a drop in temperature in the muscle tissue. When using a warming lotion, the temperature remains constant when applying effleurage; it rises with petrissage and drops slightly with tapotement. Rubbing in a warming hydrogel or massage lotion leads to a drop in temperature.

***Table 1**: Skin Temperature*

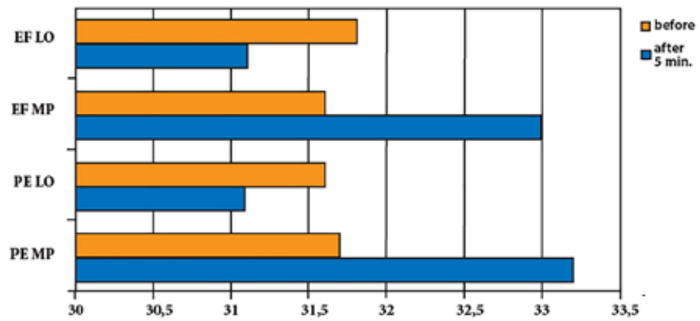


***Table 2**: Skin Temperature*

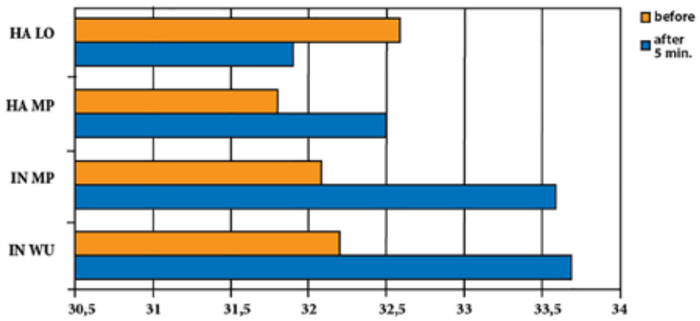


***Table 3**: Muscle Tissue Temperature*

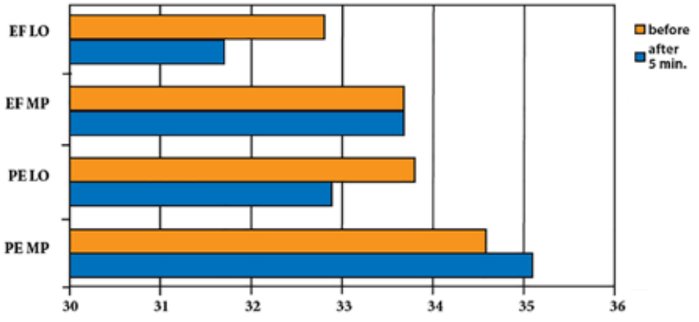
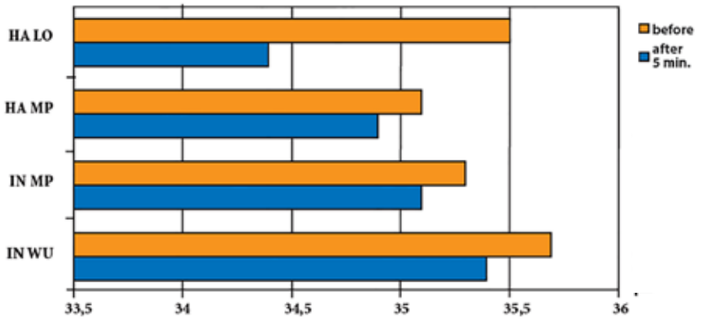


***Table 4**: Muscle Tissue Temperature*



CONCLUSION

Applying or just rubbing in warming products only creates an increase in blood circulation to the skin. It is only when used in combination with specific massage techniques that warming products have a significant effect. Massage creates a drop in temperature (ten minutes after massaging, the blood that has been massaged away has not yet been replaced) that is compensated for by the effect of the warming product. In order to obtain an active hyperaemia in the muscles five minutes after a massage, a vasodilatation product is needed, combined with an intense massage (petrissage).

OPERATION MECHANISM: SHUNT

The receptors are awakened when applying a warming product. Neuropeptides that are responsible for vasodilatation are separated out.

The network of blood vessels in the skin is more extensive than is needed for nourishing this organ, partially because the thermo-regulation is controlled by the skin. At room temperature, blood flows just to 50 to 70% of the capillaries. Under the influence of heat and cold, skin temperature changes and the thermo receptors are awakened sending a signal to the central nervous system. The blood vessels in the skin awakened, thus the muscles react to this: vasodilatation with heat, vasoconstriction with cold.

A speedy regulation of the blood supply can be achieved through arterio-vascular anastomoses (natural connection between blood vessels), also called shunts. When influenced by hot and cold, shunts can cause extreme differences in blood supply: an increase from 0.3 ml/min to 150 ml/min blood per 100 mg of tissue. These differences have an influence on the underlying of muscle tissue.

The local application of a heating product has the same physiological effect as external heat, as is described above. Hence the great importance of protecting the skin with a lipogel (product made exclusively from oil, such as NAQI® Warming Up Competition) when in a cold environment, in order to avoid loss of body heat. This switches off the natural protection.

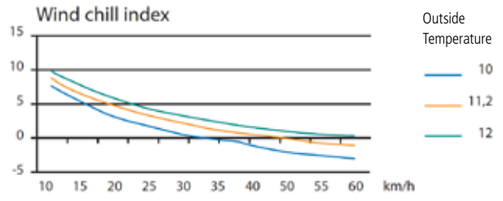
MUSCLE WARM-UP

Cold muscles in a relaxed state should not be suddenly put into motion. This could cause them to tear. A warm up is necessary before any sports/exercisesin order to increase the temperature of the muscles. A passive warm up can increase the temperature in the same way as an active warm up – but without drawing on any energy reserves. Passive warm ups are also important as a complement to the increase in temperature from active warm ups or in order to maintain the temperature.

When skin is moist or wet, it loses 25% more heat. Therefore, when it rains, an oil should be applied in order to reduce the loss of heat. This is even more important in cold weather conditions. The body reacts to the cold by narrowing the blood vessels so that it can maintain the body temperature. A cold environment can reduce blood circulation to a third of its normal volume. This occurs not just at skin level, but also in the underlying muscles, with the result that the blood supply is reduced and the body temperature drops.

Bodies lose more warmth at a temperature of 10°C and a wind speed of 40 km/h than at -5°C with no wind. These factors hamper performance and increase the risk of injury. Heat loss is reduced by using a water-free and water-resistant product. A lipogel, for example, provides specific long-lasting protection against cold, wind, and rain.

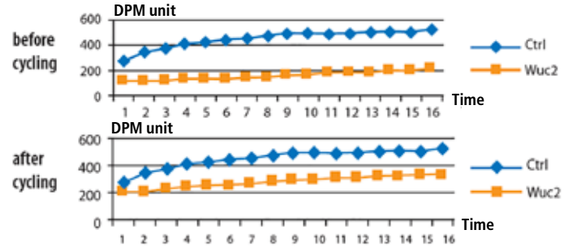
Applying a product that stimulates blood circulation and also protects against the cold lengthens the effect of the active warm up and doubles the duration of the protection. This promotes the capacity to function as well as coordination. The Naqi Warming Up Competition range was designed specifically with this in mind. The film left on the skin by this product does not hamper the skin's normal functions and is particularly suitable for outdoor sports or to maintain vasodilatation achieved after a massage.



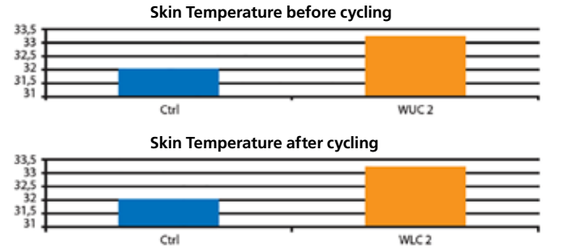
Source: Warm up I: potential mechanisms and the effects of passive warm up on exercise performance Bishop D. Sport Med. 2003;33 (6): 439-54
Warm up II: performance changes following active warm up and how to structure the warm up Bishop D. Sport Med. 2003;33 (7): 483-98

RESEARCH

Scientific research has revealed that there is a significant effect when applying a warm-up lipogel at 12°C. Fifteen people were treated with NAQI® Warming Up Competition 2; after 15 minutes, their skin temperature and water release were measured against a site on the body that had not been treated with the product. The volunteers had to cycle outside for 30 minutes and 15 minutes after coming back in; the measurements were then taken again.



DPM is a measure of the actual stratum corneum hydration



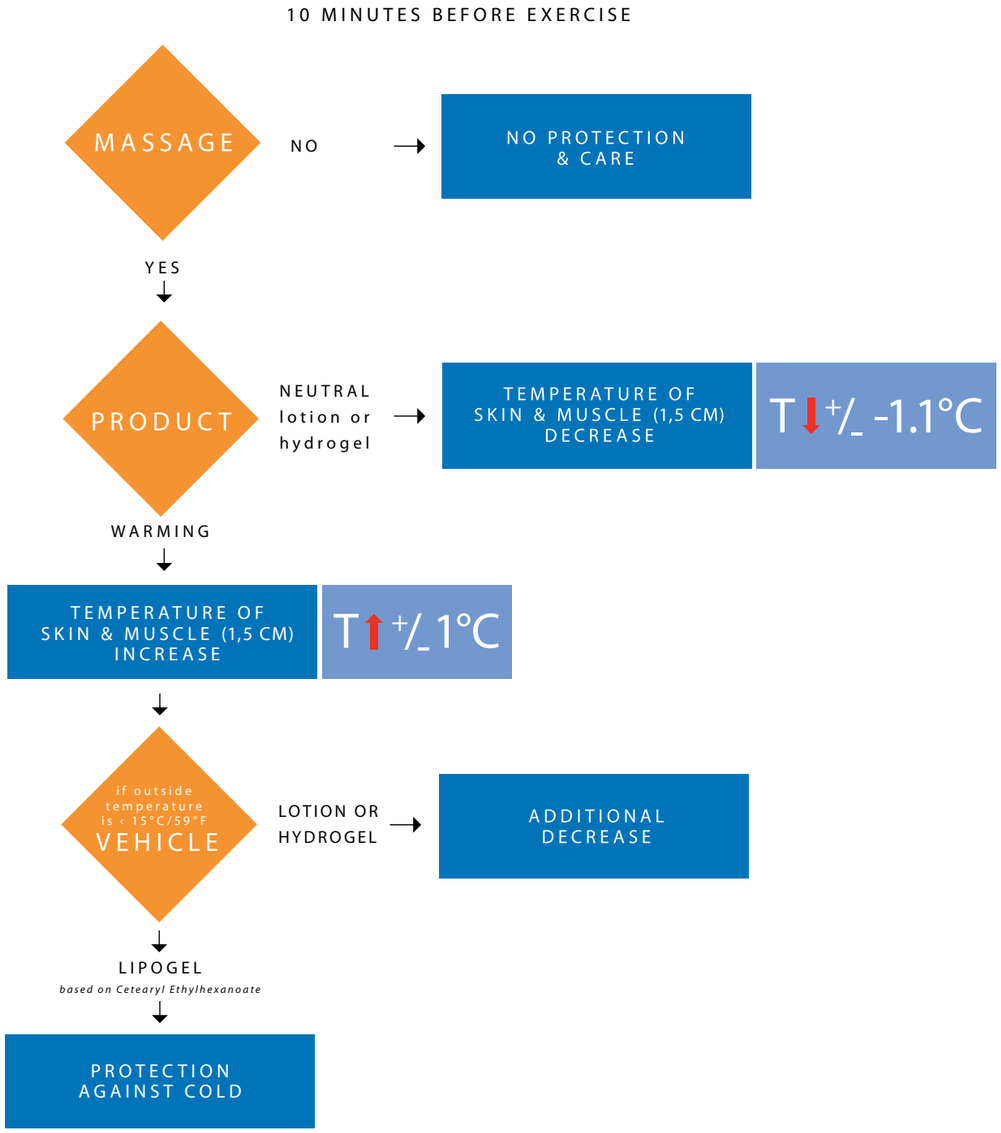
Source: Biometrological Assessment of Skin Protectors against Moderate Cold Threat. G. Claes, G.E. Piérard Exog. Dermatol. 2002;1: 92-96

RESULTS

The following figures clearly illustrate that the application of the lipogel results in a significant drop in water release. After cycling, we noticed a significant increase in water release among the sample group, which goes hand in hand with an increase in heat loss. The lipogel maintains the significant reduction of heat loss after cycling. NAQI® Warming Up Competition 2 (WUC 2) increases the temperature of the skin. After cycling,the temperature drops overall. The lipogel really maintains the temperature higher than the sample site, and therefore guarantees less heat loss.

WHY USE WARMING PRODUCTS IN COLD WEATHER

The table below illustrates the importance of the use of warm-up products for certain treatments and the necessity of lipogels, such as NAQI® Warming Up Competition before exercising in cold weather.



15°C Airless Bottle easy-to-use

WARMING UP COMPETITION

(WUC2)

Protective and water-resistant lipogels that stimulate the circulation and protect against cold without impeding the skin's normal functions. Pleasant feeling of warmth, makes the skin slightly red. Inclement weather conditions.

15°C Airless Bottle easy-to-use

VOTRA PLUS

This lipogel protects the feet against the cold and slows down heat loss without impairing normal skin functions. Massage NAQI® Votra Plus into feet in cold weather. Repeat if necessary. Avoid contact with the face and mucous membranes.

ICE MARATHON

— Interview by Wesley Muyldermans, sports journalist & writer—

GERTJAN VERDICKT IS AN AMATEUR ATHLETE FROM LONDERZEEL. HE IS CURRENTLY DOING A PHD IN APPLIED ECONOMICS, SPECIALISING IN FINANCIAL MARKETS, AT THE UNIVERSITY OF ANTWERP. HIS SPORT C.V. INCLUDES 15 YEARS OF BASKETBALL AND 2 YEARS OF BADMINTON. GERTJAN CAUGHT THE RUNNING BUG 6 YEARS AGO AND RAN BOTH THE BRUSSELS MARATHON AND THE ROME MARATHON TWICE BETWEEN 2011 AND 2014. THIS WAS THE PERFECT WAY TO PREPARE FOR HIS GREATEST CHALLENGE TO DATE: AN ENTIRE YEAR OF RUNNING FOR AND WITH MS PATIENTS, CULMINATING IN THE ICE MARATHON IN ANTARCTICA. IN THIS INTERVIEW, GERTJAN TELLS US HOW TO PREPARE FOR PHYSICAL EXERTION AT SUCH EXTREMELY LOW TEMPERATURES.

Gertjan, an Ice Marathon is not something that you do every month or even every year. Why are you doing this?

I'm running for charity and all donations will go to the operation budget of the Flemish Multiple Sclerosis League. I was confronted with MS, a disorder of the central nervous system, after it affected several people in my direct environment within a short period of time. I also have friends working in the MS centre in Melsbroek. At first, I knew practically nothing about the disease, but I started to learn more about it. I used to think that MS was a muscle disease, but it is not.
A friend told me how she can no longer put on her trousers after a MS attack. As an enthusiastic runner, I thought to myself: "I can still run. I have to draw attention to this by running and participating in the Ice Marathon. I have already completed four marathons, two in Brussels and two in Rome. By running the Ice Marathon I want to go a step further to show people that I am going to do something as extreme as running in Antarctica. The difference is that for me this event will last just four hours or so and then it will be over. People living with MS have to cope with having a ticking time bomb inside them their entire lives. One day they may be fine, but the next day they could have an attack and their health could deteriorate sharply. I want to draw attention to this contrast.

How are you going to prepare for such strenuous physical exertion in extremely cold temperatures?

I am being coached by Energy Lab, which is operated by van Paul van den Bosch, who used to coach Sven Nys. They are drawing up nutrition and training schedules for me. Currently, my fat percentage is 17.7% , but this has to decrease, preferably to 10%. But this is a contentious point. On the one hand, we are not sure if a fat percentage of 10% is low enough to be really fit, and on the other hand whether it will be high enough to protect me against the cold.

In a few months' time I will start running in freezers, or cold rooms at a temperature of -15 to-20 degrees Celsius, just to get used to exercising at very low temperatures. We will not start this until next June as there is no point in starting any earlier. I'm just getting in some kilometres now to build up stamina. At the moment, I'm running for 50 minutes three times a week and will build this up to one and a half hours by the end of December. I will also try to train for at least two hours in the freezer or cold room, because the longer I can endure it in there, the better prepared I will be.

The Ice Marathon will also be mentally exhausting, won't it?

I always approach each marathon in the same way. There are days that I just don't feel like training. But I just plug in my headphones, push myself to start and set off, whether or not I feel like it. This approach also helps you to toughen up mentally. I used to play basketball, a sport that also requires you to be strong mentally, and I am now reaping the benefits. I see every training session as a new step in the right direction on the way to my ultimate goal.

It's going to be absolutely freezing in Antarctica. What are you going to wear?

I read on the organisation's website that you can run the Ice Marathon in normal shoes, and I have also seen this in short films that I have seen about the marathon. I have quite thick shoes, so they should be fine.
I will have to wear three layers of thin clothing: underwear with a thermal inside and outside, a special thin sport jacket, etc. The most important thing will be to protect my face. NAQI has a special face cream made from Ectoin and that will certainly help. I will also wear a buff and special glasses. I can't, for example, wear ski glasses because they would be too heavy. Training in freezers or cold rooms also gives you a lot of useful information about what kind of clothing I will need, and what I can tolerate, etc. The organisation says that it is best to prepare in the same way you would prepare for a normal marathon. But I prefer to leave nothing to chance.

You are training with the company of Paul van den Bosch, Sven Nys's former coach. When Nys was running races, he used to live like a monk. Are you planning to do the same?

I'm currently following a special diet. For a year, I will not drink alcohol and soft drinks, only still and sparkling water, except after a training session, when I can drink chocolate milk made with skimmed milk. I'm only allowed to eat wholemeal pasta, brown rice and brown bread. All white foods are off the menu. For example, I'm not allowed to eat pizza – one of my favourite meals – and that is not always easy. I'm also allowed low-fat meat, but no minced meat or salami. Cornflakes have been replaced by granola and oatmeal. It's a pretty healthy lifestyle.

Protecting your skin against the cold and the elements is something that can't be neglected. How are you going to go about this?

To be honest, this was not something that I had thought about until I spoke to the people from NAQI. During the Rome marathons, I did not do anything to protect my skin, but then again, it was beautiful weather there. I am very happy that NAQI is going to support me in various ways. I've been told that you have to build up your skin protection gradually, so I will start using NAQI Face Protector Sport a week before I start training in the cold room. I will continue to build this up until the race to ensure optimal face protection. I will also use NAQI Recovery Gel to speed up my recovery. I can really count on good coaching from NAQI, because their R&D is going to offer help when necessary to make sure that I start the Ice Marathon with optimal skin protection. My physical therapist will also receive support with products especially for therapeutic treatments.
Friction is another problem that could occur. If I have to wear shorts for longer than an hour, I make sure that they are very close-fitting. As I said, I used to play basketball, where I wore very loose shorts, so I know what friction can do.

Your initiative is now receiving a lot of attention and this may inspire other people to do something similar. But they may have doubts. What would you say to convince them?

I think that it is better to try something than to spend the rest of your life wondering whether or not you could have done it. This is always my attitude at the start of a marathon. It is a short period of hardship, but you will be glad you did it for the rest of your life. The same goes for the Ice Marathon. I will have to grit my teeth for a short while, but I will receive so much in return. The first time I crossed the finish in Rome – five years ago now – I was overwhelmed by a roller-coaster of emotions. I can only recommend other people to do this!

For more information on Gertjan's initiative, RUN FOR MS, to check all the runs in 2016-2017 or to make a donation, visit www.runforms.be

On the RUN FOR MS blog, Gertjan shares some tips and experiences of his journey towards the Antarctica Ice Marathon on November 24, 2017.

ARE HYDRATION NEEDS DIFFERENT IN WINTER VERSUS SUMMER?

SWEAT RATE

Many athletes are surprised to learn that their sweat rate does not change just because the temperature drops. The sweat rate is also determined by numerous factors, including fitness level, pace, and acclimatization. Athletes are just as likely to become dehydrated during winter workouts as they are during summer workouts. Staying hydrated is very important when exercising at any time of the year; otherwise, it will negatively affect your performance.

It depends on several factors. First, athletes sweat less (**Figure 1**) and feel less thirsty during winter workouts, so they are more likely to ignore their hydration needs. Second, many athletes overdress for cold-weather exercise sessions. They either excitedly wear every layer of new gear or they are so sick of being cold all day that they over-dress just to warm up. Third, when we exercise indoors, we sweat more than outdoors, so it becomes easy to get behind on hydration during long indoor runs and stationary cycle rides.

Figure 1: *An approximation of the hourly sweating rates (liters per hour) for runners. Running speed is indicated in meters per minute and in minutes per mile. (Sawka, M.N., and K.B. Pandolf 1990. Effects of body water loss on exercise performance and physiological functions. Pp. 1–38 in Perspectives in Exercise Science and Sports Medicine. Vol. 3, Fluid Homeostasis During Exercise, C.V. Gisolfi and D.R. Lamb, eds. Indianapolis, Ind.: Benchmark Press.)*

(DE) HYDRATION

To avoid dehydration during winter make sure you drink enough during exercising. But also before and after exercising it is very important to keep yourself hydrated. Ensure you drink enough to replace lost fluids. For exercises lasting more than 1 hour, it is recommended to drink 0.5L per hour exercise. Use your urine colour as a way of checking your hydration status at the end of a run. Your urine should have a light straw colour; too dark means you're dehydrated, but too light means you're drinking too much (**see figure 2**)!

When exercising watch for signs of dehydration which include dizziness, headache, muscle cramping, sudden increase in heart rate and dry mouth / excessive thirst. If you experience any of these symptoms, either drink fluids immediately or stop your workout for the day, depending on the severity of your symptoms.

Figure 2: *Your urine should have a light straw colour; too dark means you're dehydrated, but too light means you're drinking too much.*

Audrey Baguet

PHD MOVEMENT AND SPORT SCIENCES, GHENT UNIVERSITY
INTERNATIONAL PRODUCT AND INNOVATION MANAGER ETIXX SPORT NUTRITION

ISOTONIC

An isotonic drink, such as Etixx Isotonic, is ideal for maintaining or restoring our fluid balance. When we exercise and consequently lose sweat, we need to replenish our electrolyte and salt level and then the ideal drink is Etixx Isotonic. During winter times or when there is little time to drink during exercise, Etixx Carbo-Gy can be consumed. This drink can be consumed either cold or as a stimulating hot fruit tea.

CARBO-GY / ISOTONIC	*Etixx Carbo-Gy*	*Etixx Isotonic*
CARBOHYDRATES (G/SERVING)	*66*	*~30*
ELECTROLYTES		*X*
TYPE OF DRINK	*Hypertonic energy drink*	*Isotonic thirst quencher*
WHEN TO TAKE	*BEFORE and DURING exercise*	*BEFORE and DURING exercise*
WARM WEATHER (>10 °C)		*X*
COLD WEATHER (< 10 °C)	*X*	
PURPOSE	*Energy reload*	*Reload: - fluid - energy - electrolytes*
TARGET GROUP	*Endurance athletes and team and racket athletes*	*All athletes*

Scientific publications: International peer-reviewed publications p46

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HOW DOES POLLUTION AFFECT US P5

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