PROJEKT WELLCOM

**Zentrum für Gesundheit**
der Deutschen Sporthochschule Köln

**Centre for Health**
German Sport University Cologne

*“Cycling and Health”*

# Compendium

ZENTRUM für Gesundheit
DER DEUTSCHEN SPORTHOCHSCHULE KÖLN

This compendium has been prepared with support from Selle Royal S.p.a..

**Responsibility of:**

Prof. Dr. Ingo Froböse

President of the Centre for Health at the German Sport University Cologne

**Project management:**

Kim Tofaute

**Contributors/collaborators:**

Ivo Ahlquist, Sascha Auerbach, Corinne Bender, Bianca Biallas, Leonie Heckenbach, Nina Kehr, Gunnar Schmidt, Birgit Wallmann

## Introduction

Health and well-being are two of the most important parameters, which directly influence the quality of life of each and every individual.

Neither is a fixed condition, which we somehow hold, but instead are process events for which we have to do something for them to exist. Which is why it is not for nothing that lifestyle is so enormously important for health and well-being and therefore requires an active way of life. If this principle is not adhered to, then in most cases the initial problems arise relatively quickly. Therefore, it is not for nothing that incorrect diet, too little exercise, stress and other factors are the cause (Stat. 1) of many illnesses and yet are so easy to correct.

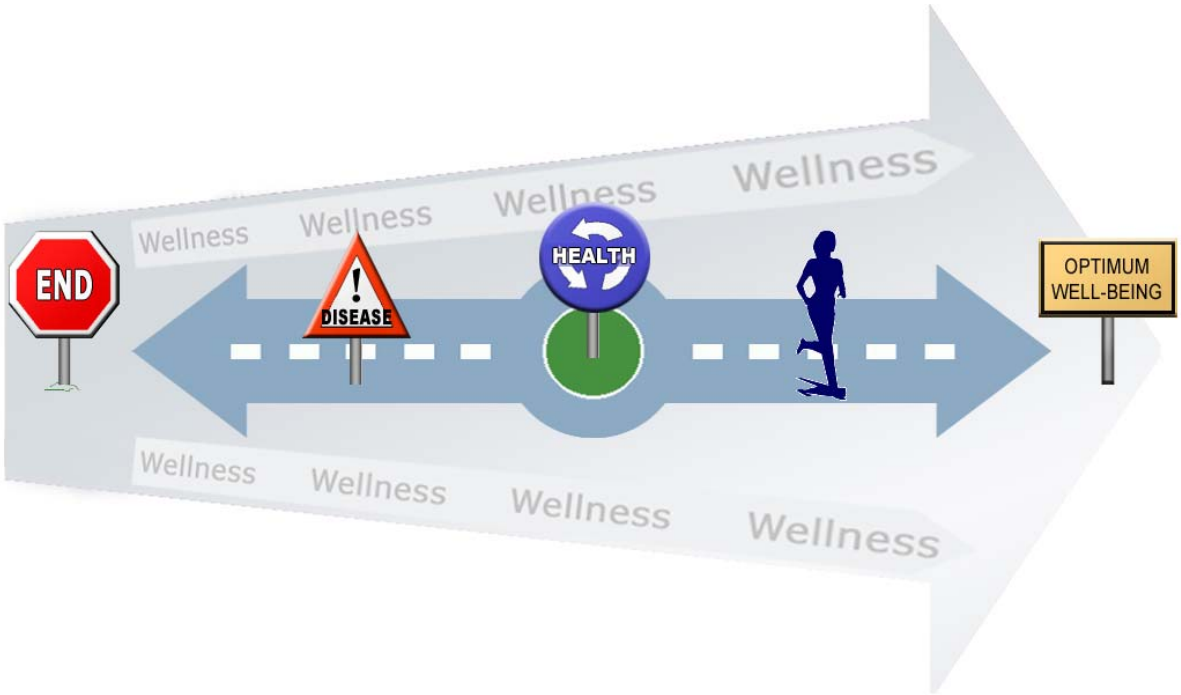


**Fig.0: Wellness model**

There is no clear demarcation between sickness and health – both are processes that are fluid and which can be influenced. Which makes it even more important for this process to be directly and actively tackled by everyone, in order to profit from personal well-being as intensively and as long as possible. Once the “opposite side” or the neutral point has been exceeded or left, then adapting lifestyle to the needs becomes a real pleasure.

A lifestyle, characterised by correct diet, adequate exercise and purposeful stress management strategies can very quickly and easily increase health and well-being and it doesn't take much.

Especially cycling, as the most widespread exercise activity (Stat. 2), with its high health potency, its high experience factor and the "gentle" form of exercise or exertion serves as an excellent type of healthy sport. Above all the motives of health and fitness are increased in its significance as a sport motive (Stat. 3). In this way virtually everyone can do something for their health and well-being and can even integrate it in their normal everyday life. It couldn't be easier!!

In this compendium we want to explain the major benefits of cycling as a form of exercise and to make it more accessible. To do this, we have prepared hit lists, how cycling helps against certain complaints and restrictions, which positive effects also result for "healthy" people and how the cycle can be optimally used. This is above all interesting for the large number of people who do not any classical sport. For example around 40% of German women do not do any sport (Stat. 4), however this target group frequently cycles. You health will thank you for it and you will certainly feel better. Try it and get involved in it with us.

**The compendium consists of 3 parts:**

The first chapter presents the positive effects of cycling and describes in detail the changes to the organs and in the body. To this end, a selection of the respective scientific studies which have examined and verify these adjustments are also included.

In the next chapter we describe how the cycle can be made individually "ft". To do this, it must be optimally adjusted to the body size and equipped according to the individual wishes and needs. Special attention is paid to the contact points between man and cycle, which are so important for comfortable enjoyment.

The last section explains how the cycle can be optimally used and how to best do something for your health. Special training schedules, differentiated according to wishes and prerequisites, show the possibility for each person to optimally use cycling as an optimum means of training and this with only minimum effort.

Prof. Dr. Ingo Froböse
Centre for Health
German Sport University Cologne

# Chapter 1:

## The Top Topics of Cycling and Health

## Part 1: Influencing negative aspects (diseases/risk factors)

## Part 2: Cycling and its effect on the organism

## Part 3: Positive effects on health

## The top topics of cycling and health

In this chapter the special aspects of cycling are presented with respect to health. Literature sources in the worldwide Medline database were searched through to produce the following lists. In addition, we setup our own databases for various topics. More than 7000 literature sources were identified and processed. The most up-to-date and best of them were used as references for the corresponding topics. The list is subdivided into the section/focal areas:

1. **Influencing negative aspects (diseases/risk factors)**
2. **Cycling and its effect on the organism**
3. **Positive effects for health**

**Tab. : Top 20 list of topics**

| 1. | Influencing negative aspects | 2. | Effect on the organism | 3. | Positive effects for health |
|---|---|---|---|---|---|
| 1.1 | Body weight & adiposity | 2.1 | Stamina | 3.1 | Beauty/ attractiveness |
| 1.2 | Mental stress | 2.2 | Anti-stress training | 3.2 | Heart function |
| 1.3 | Cardio-vascular diseases | 2.3 | Power workout | 3.3 | Oxygen & circulation |
| 1.4 | Fat metabolism & hypercholesterol | 2.4 | Fat combustion | 3.4 | Balance/ equilibrium |
| 1.5 | Spinal diseases & back pains | 2.5 | Cycling as joint protection | 3.5 | Skeletal system |
| 1.6 | High blood pressure | 2.6 | Back pain prevention | 3.6 | Muscles |
| | | 2.7 | Quality of life | 3.7 | Immune system |

# 1. Influencing negative aspects (diseases/risk factors)

Cycling can have a direct positive influence on many and very different organic and systemic factors and parameters. In the following we present the most important influencing possibilities of physical activity and especially cycling on diseases, risk factors, health impairments and disruption to the well-being. Parallel to this we list the most important scientific studies, which supplement these explanations. In addition we quote several statistical details which underpin these theses. The information usually refers to Germany, however, with slight deviations, this data is similar for most European countries.

From 1992 to 2001, expenditure on health per inhabitant rose continuously by 35%. The annual costs lie between 2000 and 3000 Euro per year (Stat. 5). A calculation from Austria was able to show that sport can considerably reduce health costs (- 264 mln. Euro / per year) . This is calculated above all from the reduced number of lost working days and the savings in health expenditure (Stat. 6). The diseases and complaints change depending on age (Stat. 7).

## 1.1 Body weight and adiposity

Approx. 1/5 of the German population is overweight (according to the Body Mass Index (BMI) > 25). The BMI is a simple standard value for determining corpulence. This is determined as body weight divided by the square of body height in metres (formula: BMI=body weight/(body height)$^2$). Carious statistics show 4/5 of the population in Germany has an appropriate weight or is underweight (BMI < 25). In the EU, 6-7% of the people suffer from adiposity (BMI > 30). One factor for obesity is belonging to a social class. For example, members of the lower social class are frequently obese. This applies in particular to women. For example, 31.4% of women in the lower class are obese, but only 9.9% of the upper class women in Germany (Stat. 8). These people are especially exposed to increased risk of becoming ill or dying from civilisation diseases such as heart failure, high blood pressure or high cholesterol values (Stat. 9). In addition, physical fitness is reduced considerably (Hulens et al. 2003;Tell & Vellar 1988).

**Tab. 2: BMI classification from the Deutsche Gesellschaft für Ernährung (DGE – German Society for Nutrition)**

| Classification | m | w |
|---|---|---|
| Underweight | < 20 | < 19 |
| Normal (appropriate) weight | 20-25 | 19-24 |
| Overweight | 25-30 | 24-30 |
| Adiposity | 30-40 | 30-40 |
| Massive adiposity | > 40 | > 40 |

Many persons who suffer from adiposity also have psychological problems and thus often have a limited quality of life. In most cases the reasons for the adiposity can be positively influenced by a change in everyday behaviour. Through regular sport exercise and a specially adapted, balanced diet, weight reduction is easily possible in most cases (Engelhart et al. 1996). In addition, the risk factors such as hypercholesterol and others can be reduced. Physical fitness can be considerably improved by physical training (Davies et al. 1975).
Cycling, in which almost 70% of the body weight is borne by the saddle, is especially and eminently suited for this target group, in order to increase their physical fitness and to stimulate fat metabolism, so important for these people; without overstraining the passive musculoskeletal system. For example, during jogging 2 to 3 times the body weight is borne by the hip joint, which would represent a massive overload for these patients.

At the same time the secondary concomitant symptoms are reduced so that overall this “gentle” form of exercise minimises the symptoms. Of course, cycling also contributes to weight reduction by burning energy.

1 h cycling = 600-800 kcal.
2 h cycling = 1200-1600 kcal
(depending on the intensity of effort)

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## 1.2 Mental stress

Mental problems and psychological stress are frequently the causes of an intensive dysaesthesia or for many diseases. The psychological disorders are among the most frequently treated diagnosis groups (Stat. 10). One special disease under this aspect is alcoholism. In the USA, over 14 mln. people are alcohol dependent. Various studies show that the negative effects can be reduced by sport and exercise (DiLorenzo et al. 1999). Moreover, positive consequences of sport on the hormone level have been verified. Hormones frequently influence the psychological disposition (Wennlund et al. 1994). People who suffer from depressions often take medicines which control their hormonal balance. Sport and exercise such as cycling sometimes have the same effect on the body, as they stimulate hormone production by the human body. SUH ET AL. (337-45) were able to show that anxiety and depression can be reduced by doing endurance sports and the patients are able to reduce their medicine intake.

As cycling has a massive relaxing effect, due to its uniform, cyclic form of movement, this is expressed in psycho-physical regulation, which lead to stabilisation of all physical and emotional functions and thus breaks down the effects of the stressors. A balance sets in, which is understood as being harmony. In particular, we also know that during long continuous, uniform endurance sport activities, which includes cycling, pain-inhibiting or “happy” hormones, so-called endorphins, begin to be discharged after approx. 30 to 40 mins. These counteract depressive moods and other psychological problems, so that the effect of cycling on the psyche can also be controlled hormonally. Further, strengthening of the parasympathetic vagotonus and the reduction of the sympathetic resting tonus (= arousal condition) mostly heightened during stress as well as central soothing via a neurohormonal arrangement also have a direct effect on stress.

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3. Wennlund, A., Wahrenberg, H., Hagstrom-Toft, E., Bolinder, J., & Arner, P. 1994, "Lipolytic and cardiac responses to various forms of stress in humans", *Int.J.Sports Med.*, vol. 15, no. 7, pp. 408-413.

### 1.3 Cardio-vascular diseases

Heart diseases are one of the main causes of early mortality (Stat. 11 and 12) or hospital stays (Stat. 13). In Germany over 150,000 people per year die of heart failure. In most cases the heart's functions are weakened by diseases such as arterial sclerosis or malfunctions of the ventricles. Studies show that sport and exercise have a positive effect on prevention of a heart attach or other heart diseases (Bovens et al. 1993;Suzuki et al. 1998;Willenheimer et al. 1998).

In recent decades, rehabilitation has taken a dramatic U-turn in the treatment of heart attack patients. In the past complete bed rest was initially prescribed, today light physical activity is part of the therapy (Brugger, Berghold, & Kullich 1988). In particular, these activities also include cycling, because it unites all the advantages of balanced physical exercise. Apart from the most important cardiac functions (heart rate and stroke volume), the circulations situation of the heart muscles is also positively changed by cycling. The result is considerably more economic work by the heart, which leads to reduced stress of the heart. All the risk factors which cause a heart attack are positively influenced, so that regular physical activity reduces the risk of suffering a heart attack by more than 50%. The optimum has found to be a stress limit of approx. 2000 kcal. increased consumption through cycling and/or other activities per week in order to achieve maximum protective effect against cardiac diseases.

Overall, cycling can provide the following positive effects for the work of the heart:

- Reduction of the heart beat frequency at rest and to sub maximum stress levels
- Reduction of the cardiac output (= quantity of blood per unit time)
- Lengthening of the diastole period (phase of the heart at rest, diastole (heart relation/dilation) between two beats) and increase in the diastolic relaxation speed (= faster diastole)
- Reduction in the peripheral resistance

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1. Bovens, A. M., Van Baak, M. A., Vrencken, J. G., Wijnen, J. A., Saris, W. H., & Verstappen, F. T. 1993, "Physical activity, fitness, and selected risk factors for CHD in active men and women", *Med.Sci.Sports Exerc.*, vol. 25, no. 5, pp. 572-576.
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4. Willenheimer, R., Erhardt, L., Cline, C., Rydberg, E., & Israelsson, B. 1998, "Exercise training in heart failure improves quality of life and exercise capacity", *Eur.Heart J.*, vol. 19, no. 5, pp. 774-781.

## 1.4 Fat metabolism and hypercholesterol

Body fat is the largest energy store. Among other things, fats serve as a means of transport for vitamins, through the fatty acids as a protective function for the cells and form a protective cushion against heat lost. An increased fat intake can however also disrupt the fat metabolism and thus lead to diseases for example arterial sclerosis, adiposity or high blood pressure. This can cause further diseases such as a heart attach or stroke. With increasing age the values for excessive cholesterol values also increases. On average 35 - 40% have increased values above 250 mg/dl (Stat. 13). These consequences can in part be positively influenced by sport and physical exercise (Dudaev et al. 1986). Studies show that consequential damage can be avoided or at least reduced through aerobic exercise over a lengthy period and continuously carried out (Aellen, Hollmann, & Boutellier 1993). For example, an increase in the HDL cholesterol can be determined for regular sport exercise. A higher HDL value is considered to be a protective factor for cardiac-circulatory diseases (Borodina et al. 1998). Sport during youth is also a prevention factor against excessive body weight in adults (O'Kane et al. 2002).

Cycling therefore not only trains the organism to fall back on and use up virtually inexhaustible fat reserves (this has to be trained), but a direct influencing of the fat metabolism also sets in. HDL cholesterol, so important for a protective effect, is increased by this moderate endurance activity and the “bad” LDL cholesterol, which is thought to be responsible for the “calcification” of the blood vessels, is reduced. The blood vessels remain unscathed by this and prove to be more capable of adapting. As the body weight reduces at the same time and the cholesterol values are optimised, a preventive mechanism results due to the promotion of the fat metabolism, which can be triggered by regular activities with the cycle.

***Sources:***

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## 1.5 Spinal diseases and back pains

Most of the population in industrial countries have or have had a disease and/or pains in their back at least once. Above all, one in three of people over 40 is acutely affected (Stat. 14.). Due to daily work such as sitting at a PC by an office worker with little exercise or the hard physical work of a factory worker, our backs are poorly or incorrectly stressed. Children and young people are also affected. The risk factors are similar to those of adults; excessive competitive sport, hard physical work, muscular imbalances and lack of fitness (Harreby et al. 1999). This can cause damage ranging from muscle tension to permanent malpositions through to invertebral disc injuries. This affects the whole bodily static equilibrium and causes an imbalance. Sport exercise can remove tension and strengthen the back. Studies show that moderate correctly implemented exercise reduces back pains and their consequences and can even prevent them (Weinhardt, Heller, & Weh 2001). Endurance sport can also contribute to reducing back pains (Iversen, Fossel, & Katz 2003;Woolf et al. 2002).

In an optimum posture on the cycle with an upper body slightly bent forwards, the back muscular system prestresses and this stabilises the trunk. The cyclic leg movement stimulates the muscular system, especially in the area of the lower back, the lumbar spine and the iliosacral joint. The most frequent slipped discs occur in particular in this part of the spine and this is where back pains usually occur. Through the muscular stimulus this is simultaneously strengthened and thus secures the spine against external stresses. In particular, the asymmetric stimulus of the muscular system due to the treading movements during cycling stimulates the small muscles at the vertebrae, which are difficult to reach arbitrarily through gymnastic or similar forms of training. These guarantee the so important “segmental stability” (= related to 2 vertebrae) between the individual vertebrae and can thus prevent back pains and other problems.

***Sources:***

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## 1.6 High blood pressure

High blood pressure has a major influence on the most frequent civilisation diseases (heart attack and stroke). Around 20% of the population has an increased blood pressure, a further 20% has very high (critical) values (Stat. 15). Only 10 – 20% of the people with high blood pressure (hypertensive) have a genetic disposition for this. This means that most hypertensive people can undertake something to directly counteract this condition. A large number of studies show that moderate sport exercise can prevent or at least reduce high blood pressure (Bond et al. 2002;Brown, Myles, & Allen 1983) and so the possible consequences such as a stroke or damage to organs can be prevented (Mundal et al. 1996). Intensive types of sport should however be avoided, as blood pressure rises over-proportionally especially during major strength exertion.

Without limitation, cycling is certainly one of the moderate activities, as the stress can be independently controlled and regulated. Apart from hormonal changes this also hinders resistance in the blood vessels, so that the necessary pressure can be reduced. In addition the heart's work becomes more efficient in that the heart's stroke volume increases and the heart rate reduces. This causes more blood volume per unit time to be expelled for supply and the blood pressure necessary for this is lowered.

As blood pressure can be included as one of the most important risk factors for a heart attack and a stroke, cycling can make a decisive contribution to health.

***Sources:***

1. Bond, V., Stephens, Q., Adams, R. G., Vaccaro, P., Demeersman, R., Williams, D., Obisesan, T. O., Franks, B. D., Oke, L. M., Coleman, B., Blakely, R., & Millis, R. M. 2002, "Aerobic exercise attenuates an exaggerated exercise blood pressure response in normotensive young adult African-American men", *Blood Press*, vol. 11, no. 4, pp. 229-234.
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## 2. Cycling and Its Effect on the Organism

In the following section, the most important psycho-physical effects of well-directed cycling training and its effects are explained. At the same time the effects listed here of course only account for part of all effective mechanisms, however they represent the main effects which have to be primarily observed. In addition, 95% of people believe that they can actively influence their own health (Stat. 16). This can be determined in a trend to more healthy diet or sport (Stat. 17 and 18, 19).

### 2.1 Stamina

Civilisation diseases and their consequences, such as heart attack, stroke or adiposity can be weakened and even avoided by physical exercise/endurance sports, e.g. running or cycling (Andersen et al. 2002).

Stamina describes the ability to endure a given exercise or effort for a long time. This exercise can refer to different intensities and periods of time, irrespective of whether it concerns sprint stamina or short-term stamina (less than 90 seconds duration) or an extreme long-term stamina (several hours or days). Stamina as so-called “basic stamina”, is on the other-hand the basis for every type of performance and resistance to tiredness or fatigue. Basic stamina is strengthened through moderate training at 50-75% of the maximum oxygen uptake, which lasts for at least 30 minutes (Lagerström 1995). This also has a high health benefit (Hambrecht et al. 1997), as in particular, the so important fat metabolism is trained during this training intensity. Moreover, this training intensity can also be carried out by leisure sportspersons and even by beginners.

The exercise takes place with an adequate oxygen supply (= aerobic) without energetic fatigue.

Cycling is especially good for aerobic exercise as the strain on the body is considerably less that in comparison to other types of endurance sports. The training

schedule should be individually agreed, in order to achieve the best health effects (Wehrlin & Held 2001).

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## 2.2 Antistress training

Cycling can serve in various respects as antistress training. Physical exercise not only ensures physical compensation with respect to a low exercise culture, but the psyche also profits from it (Dishman 1985;McLennan & McLennan 1991;Suh et al. 2002). Endurance sport can also lead to increased production of the “happy hormones” endorphin and adrenalin. These can have a positive effect on mood (Roth, Bachtler, & Fillingim 1990). Outdoor exercise in the free nature also provides compensation with respect to everyday life restrictions. This applies to all age groups.

The uniform, lasting exercise or effort of cycling enables it to have a regulating and stabilising effect on all physical and affective functions. It has both a stimulating and retarding psycho-physical effect, depending on the disposition and at the same time balances and harmonises all organic functions. In this case cycling has a reconciling or compensating effect – either it satisfies the unstilled need for activity where everyday requirements lack movement or exercise or it serves to compensate or balance out increased strains, particularly mental and emotional. The human organism feels both of these as stress and in all cases cycling can have an antistress effect.

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## 2.3 Power workout

Not only gentle exercise and moderate training lead to positive health changes. During intensive training and exercise units, not only a relatively increased calorie turnover (however relatively little fats!) can be recorded, but overall more demands are made on the body. Intensive exercises are often accompanied by higher technical-coordinative requirements. This can lead to a more intensive experience or greater diversion from everyday problems. Further, the muscles and the cardiovascular system is trained to a more comprehensive extent and as a result greater fitness can be achieved (Blanchard et al. 2001).

Cycling basically provides two increases in exercise:

On the one hand an increase in pedalling frequency and on the other an increase in pedalling resistance (higher gear). Both variations can also be simultaneously combined. In particular, increasing pedalling frequency causes greater stress of the cardiovascular system and movement coordination, while increasing resistance also causes muscular strains for the lower extremity (Cahill et al. 1997).

Both forms of exercise make greater demands on the organism than pure endurance training and therefore requires shorter exercise periods and longer regeneration periods.

Exhaustive (short bursts of high intensity) exercise is however fun and awakens new feelings as each fibre of the muscles is felt, exhaustion changes to tiredness and the head becomes fully free.
Such training units should always be regularly integrated, however they require a certain training condition and therefore also always have to be supplemented by normal endurance or stamina units.

***Sources:***

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## 2.4 Fat combustion

The human organism has several possibilities of gaining the energy required for exercise and training. Apart from carbohydrates (sugar), fats are the largest energy reserves we have to be included here. As we are mostly only exercised for a short time in everyday life we mostly acquire our energy through carbohydrate combustion – we have become “sugar burners”. We therefore mostly have to relearn, i.e. train, fat combustion. Yet fat combustion draws its high degree of health benefits from its influence on the risk factors for cardiovascular diseases such as overweight and hypercholesterolaemia (Aellen, Hollmann, & Boutellier 1993). In particular, the composition of cholesterols, decisive for cardiovascular diseases, is positively influenced. This way the classified risk factor LDL is reduced and the so-called protective cholesterol HDL increases (Foger et al. 1994).

Fat metabolism can best be trained through moderate “aerobic” endurance training. Therefore, cycling is an optimum form of training for the fat metabolism, because approx. 60% of the energy is gained from fats in untrained persons during extensive exercise and approx. 80% of the energy in trained persons. Exertion periods of more than 20 – 30 minutes are required in order to initially burn up and use up carbohydrates and then to stimulate the body to draw upon the less accessible fatty acids. Of course 45 – 60 minute periods are better. This effect can be determined both in trained and in untrained persons (Holm, Bjorntorp, & Jagenburg 1978).

As this is impossible for many to achieve via jogging, and is hardly capable of being realised through swimming due to its difficult technique, cycling is the ideal activity for boosting fat metabolism and for achieving the positive health effects.

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## 2.5 Cycling as joint protection

Various sport movements can at times generate considerable strains on the joints. Even with jogging, many people suffer from knee or other joint complaints. Therefore, it is especially recommended for this target to do exercise which does not result in high strains on the joint. As we know from diverse scientific studies, this is particularly the case in activities in which the joint moves cyclically and no or only very small forces act as a strain on the joint. This way the cartilage which is so important for the joint experiences an optimum feeding situation, which is so decisive for its growth (Scott 2003). Joint protection therefore means protecting and feeding cartilage and this can be especially achieved through cycling. This is due to the fact that almost 70% of the body weight is distributed to the saddle, handlebars and pedals and thus the forces that act as a result of body weight during running or walking are significantly reduced (Tackson, Krebs, & Harris 1997). This is supported by the circular movement required during cycling which creates an optimum nutrition situation for the joints' cartilage. Energy and other metabolic products can therefore be transported unimpeded up to the joint and then reach the cartilage via diffusion. As cartilage is not directly supplied by blood vessels, the only possibility for it to be supplied is via uniform cyclic forms of movements, as guaranteed by cycling (Akeson et al. 1987). Cycling therefore means actively providing joint protection and giving arthrosis less chance to develop.

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## 2.6 Back pain prevention

Cycling can reduce pain through the diversion it provides and by increased circulation in the muscular system. Moreover, the muscular system is gently strengthened by the stabilisation of the body. Combined with gymnastics for the back or therapeutic treatment, cycling can help to reduce back pains (Mellion 1994). The occurrence of back pains can be reduced by exercising the body as often muscular posture weaknesses exist with functional deficits. The position taken up on the bicycle should be “back-friendly”, by keeping the hip angle relatively large. This means that the saddle should be set relatively far forward and the steering bar should be set high (Fanucci et al. 2002). Moreover, lowering the tip of the saddle slightly causes the pelvis to tilt so that the back is relieved (Fanucci, Masala, Fasoli, Cammarata, Squillaci, & Simonetti 2002;Salai et al. 1999). But the muscular system should always be kept slightly prestressed in order to be able to actively absorb the knocks and impacts from the subsurface of the roads or paths. After all, the muscular system is our best “spring cushioning system”. To this end the position must be slightly bent forward because this causes the muscular system to be slightly prestressed. Especially the lower back, which is particularly susceptible, is strengthened as a result and thus protects the spine. In addition, the alternating up and down movement of the legs stimulates and trains the muscular system which is responsible for the so important “segmental stabilisation”, i.e. the stabilisation of the individual vertebrae. This muscular system is very difficult to activate arbitrarily and must therefore be stimulated involuntarily via receptor activity. This can primarily be guaranteed through asymmetrical movements, such as those resulting in cycling from the pedalling movement. Cycling thus directly serves to prevent back problems and at the same time promotes awareness of the body, which makes even the slightest changes in the body immediately (Froböse, Nellessen, & Wilke 2003).

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## 2.7 Quality of life

Quality of life is described as the result with which an individual uses their skills to form an individually optimum life and deals with problems in the social environment. This especially applies to older people for whom the quality of life often falls. The causes of this is not only health complaints but also functional reductions. However, quality of life is very highly individually characterised and can therefore only be influenced individually. Numerous scientific studies have proven that physical activity and the associated experiences have a direct effect on well-being and thus on health too (Willenheimer et al. 2001;Yanagibori & Shirai 2002).

Cycling has numerous advantages, which can directly affect the quality of life, as both physical functions as well as emotional-affective factors can be directly and positively influenced (Radzewitz et al. 2002). Regular and lasting exercise and sport should be done in order to permanently increase the quality of life.

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## 3. Positive effects on health

Apart from influencing negative physical developments and diseases, cycling can also achieve diverse preventive effects. Therefore, in the following we have described the most important preventive factors of cycling, which are not only limited to clear physiological functions, but also include its effect on the physical image (i.e. the way we look) and individual well-being. All aspects contain direct or indirect active mechanisms for health and thus have direct access to life-long health. Thus more than 80% should consider their health to be satisfactory or better (Stat. 20).

### 3.1 Beauty / Attractiveness

In today's society, beauty and attractiveness are synonymous with success, money and standing. This is directly linked with the words "fit" and "sporty", which shows that exercise and sport thus have an enormously high societal standing (Ferriani et al. 2000).

Special activities such as bodyshaping and bodybuilding are precisely focused on these needs and document the particular influence of special forms of training. Common to all these activities is that they are designed to achieve a body weight regulating, muscle and tissue firming and profiting effect. As the proportion of body fat mass plays a major and decisive role, all these activities have a special significance, which directly influence this. Applied in a coordinated way, cycling achieves precisely this goal. This is accompanied by positive effects on the muscular system (development and tightening), the physical feeling and perception, which ultimately directly influence the effect of persons on their environment. Equally, fit persons are generally also perceived by their environment to be positive and attractive (Singh 1994).

Naturally, the skin also profits from the activity, as the circulation increases and the metabolic processes are stimulated, which lends active persons a "fresh" and "healthy" expression. The changes that occur to the body through sport create an

increased and intensive “physical feeling”. In many cases this leads to an increase feeling of self worth (Loland 2000).

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### 3.2 Heart function

The heart is one of the most important organs and at the same time its muscles' blood supply is among the best in the human body. At rest it beats 60 – 90 times per minute and up to 200 times under exercise and with each heart beat it pumps blood enriched with oxygen into the body's circulation system. The heart's strength can be impaired by diseases such as arterial sclerosis or due to a heart attack, but inactivity also damages the heart. It is made of muscle and this must be continuously "trained", because its functional capacity is otherwise partly lost. Special endurance activities, during which the work of the heart is increased for a lengthy period of time and the heart's functions are exposed to increased strain are particularly suited for triggering positive adjustments to the heart and in its functions (Ziemba et al. 2003). The untrained and training beginners must start this exercise slowly and moderately and, if they have already passed their 35$^{th}$ birthday, should always have their training and exercise capability certified by a physician before starting training.

As, especially at the start of training, the body's systems cannot sustain identical levels of strain and display varying adjustment speeds, training on a cycle is recommended to train the heart function as well as the overall cardiovascular – metabolic processes. During this the system experiences optimum stimulus without over-exerting the "inert" passive systems (bones, joints, etc.). In detail the training results in:

- Increase in the cardiac stroke volume and reduction in the basal frequency (heart stroke frequency) (Froböse, Nellessen, & Wilke 2003)
- Strengthening of the cardiac muscles (Bowles & Wamhoff 2003)
- Improvement in heart circulation (coronary arteries)
- Extension of the diastole period (= phase of the heart at rest) and increase in the diastolic relaxation speed (= heart muscle becomes limp between two beats ) (Ishida & Okada 1997)

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### 3.3 Oxygen and circulation

Oxygen is vital for all biological organisms and the basic prerequisite for the respiratory processes of humans. Respiration is often impaired by adiposity and lack of exercise. Among other things, regular sport activity strengthens the respiratory muscles, which leads to improved ventilation of the lungs and thus has a positive effect on oxygen exchange. A high oxygen uptake capacity can be trained, especially through cycling, which can reach peak values of 75-85 ml per kilogram body weight (Lee et al. 2002). But purposeful activity can also have a positive influence on the processing of energy by the cells.

Enormous positive health effects can be achieved in energy uptake and processing, especially through cycling within the moderate exercise range (Kjaer, Andersen, & Hansen 2000).

The following adjustments can take place within the organism:

- Enlarging and increasing of the mitochondria, the cells' power station, which are so important for the provision of aerobic energy (Ryschon 1994)
- Increasing the activity of effective enzymes
- Increasing the myoglobin balance (by up to 100%) – (myoglobin serves to supply the muscles with oxygen)
- Enlarging the glycogen depot
- Increase in potassium content (potassium is important for all active muscle processes in the body)
- Improved intramuscular blood distribution (Froböse, Nellessen, & Wilke 2003)
- Opening resting capillaries (= to date non-required smallest blood vessels) and extending and lengthening existing capillaries

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### 3.4 Balance / Equilibrium,

During the course of the last century our world became faster and faster – fast food, supersonic aircraft, one appointment or deadline follows the next. This negative stress often causes the inner balance to shake (Esch 2002;Kjaer, Andersen, & Hansen 2000). This is noticeable physically through increased frequency of illnesses and feeling unwell, as well as mentally in the thoughts of being overtaxed. Inner balance is decisive for a healthy body and mind. A hectic and hard working day can be balanced out through sport activity and thus positively influences the physical-spiritual equilibrium. Although sporting activity is also understood to be a further strain, its effect always tends to be relieving. This relief results from the breakdown of bottled up physical energy, from the harmonisation of physical processes and mental and emotional relaxation (Seiler & Birrer 2001), which occurs as an accompanying result if the correct, suitable activity is selected. Physical activity therefore serves as psycho-physical regulation, as all processes settled down during the post exercise phase and create a functional balance – inner balance is the result. This is necessary to be able to survive the stresses and strains of everyday life without damage and to keep the quality of life at a high level.

All activities, which take place without stress, if possible, and are disturbed by few external influences are specially suitable for this. Uniform, lengthy exercise is especially predestined for this because it acts like meditation and enables all the rigours of everyday life to disappear. Cycling with its diverse relaxing components is ideal for reinstating this balance. Physical exercise therefore acts as a relief and thus produces the balance between exertion and relaxation which is so important for inner equilibrium (Melchionda et al. 2003). Harmony only sets in if both conditions are balanced.

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### 3.5 The skeletal system

The skeletal system forms the body's basic supporting framework. It is held together by muscles, tendons and ligaments. Exercise and the accompanying strain on the skeletal system strengthens it and increases mobility (van den Ende et al. 1996). Over the years, a lack of exercise can reduce bone strength. Sport exercise, such as running, weight training or cycling, can have a positive effect on bone density through their alternating exertion and relief. Moreover, a muscular system strengthened by sport and exercise supports and protects the skeletal system.

Especially the bone system, the support system so important for our bodies, requires many and diverse strain stimuli, as it is "bradytrophic" with respect to its supply structures (= without distinctive blood supply and with limited metabolism) (Greendale et al. 2003). This means that only changes in strain can trigger the relevant adjustments. Cycling guarantees this because it ensures that the whole skeletal system is strained and thus promotes the development and breakdown activity of the bones.

In detail, the following result from physical activity (Froböse, Nellessen, & Wilke 2003):

- Hypertrophy (= volume increase) of the bones through increase in bony substance (osseous tissue) and bone cortex
- Spongiosa hypertrophy (= increase in the bone's networks) and thus strengthening of the bony trabecula structure
- Adjustments in the cartilage structures due to improved supply(diameter growth)
- Increased formation of bone protrusions at the joint zones of muscles, ligaments and tendons

Especially for persons with osteoporotic changes / degeneration (= degradation of the bone tissue's mineral and protein content) it is therefore particularly important to develop specific strains for the skeletal system, without overloading them (Going et al. 2003). Because it is important that this system only adjusts very slowly, which is

why only moderate exercises are purposeful and necessary for the skeleton and this is ideally guaranteed by cycling.

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### 3.6 Muscles

“What remains unused wastes away – what is used develops”. This saying is especially true for muscular systems, which on the one hand is relatively easy to train, but on the other hand also reacts very sensitively to inactivity. A week of inactivity reduces the strength of the muscular system by up to 50% and can even harm them long-term. Humans have several hundred muscles, which have to be constantly trained accordingly in order to maintain fitness and health. This is specially true for older people as due to biological reasons alone, the aging process causes the muscles to “shrink” (Short et al. 2004).

But we know from many studies that this degenerative process can be actively halted merely through adequate exercise and by appropriate stimuli (Skargren & Oberg 1996).

Older people who still actively do sports have a considerable better muscular potential than inactive persons. This must be used, because the muscular system is thankful for muscular system is thankful for each training stimulus and still continues to adapt itself even in increased age. It is never too late to start!

During cycling, not only the cardiovascular system is trained, but also the muscular system of almost the whole body. The leg musculature is responsible for the pedalling movement, the rump musculature (abdomen and back) stabilises the body on the cycle and cushions external influences and the shoulder-arm muscular system supports the body at the handlebars. All this trains and tightens up the muscular system, makes it stronger and retains its function, which can then be used in everyday life. The muscular stimulus is seldom so large that the muscles grow and thicken, but they do become more powerful and efficient. The local muscular stamina improves due to optimisation of the metabolic processes and the cellular processes, the muscles’ ability to interact in a coordinated way improves, and the ability to recruit the muscle fibres improves, which results in increased strength development (Hambrecht, Fiehn, Yu, Niebauer, Weigl, Hilbrich, Adams, Riede, & Schuler 1997).

The leg muscular system especially profits from the pedalling movement, which can even become hypertrophic by selecting higher gears, as the familiar pictures of racing cyclists demonstrate.

Cycling is therefore not only for stamina – the muscular system also profits greatly from it and retains numerous capabilities for us long-term, e.g. walking and running. Let's use these possibilities!

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### 3.7 Immune system

The immune system primarily serves to defend the organism from pathogens and foreign particles, which penetrate it from the outside. Furthermore, it is able to identify and remove the body's own pathologically changed cells (immune reaction).

Immune system disorders, which result in the organism having an insufficient or lack of immune reaction when coming into contact with pathogens or foreign particles, lead to increased susceptibility to infections and even to many and diverse systemic diseases.

Studies show that especially moderate endurance sports such as running, swimming or cycling strengthen the immune system and can thus contribute to a healthy life (Tvede et al. 1993;Weber 2003).

It is not for nothing that precisely these activities are also used in the prevention and rehabilitation of aids sufferers and cancer patients. Studies indicate a temporary improved defence situation after physical exercise, which can be detected both at the cellular and at the humoral level. The mobilisation and activation of the phagocytes (= cells which engulf or absorb bacteria or foreign particles) in particular represents the first barrier for infection. This is followed by phagocytosis (activation for elimination of cells) of the macrophages (cells in our immune system), which display a specific immune resistance. Further, specific physical activity can trigger the discharge of the bodies own opioids (= the body's own chemical compounds similar to morphine), which allow the onset of a positive mood and feeling of well-being in humans (Lötzerich, Peters, & Uhlenbruck 1996).

Intensive endurance training can however lead to a weakening of the immune system. Therefore, preference is to be given to moderate training intensities (Nieman 1998; Weber 2003).

Furthermore, it has been impressively proven in animal experiments that moderate endurance training provokes increased activity against tumour cells, which clearly

shows the way in which this form of exercise acts under preventive aspects (Ortega et al. 1995).

This is precisely where cycling starts and stimulates the immune system so that the body is considerably more resistant to pathological developments and external attacks by bacteria, which cause infections. This increased reaction situation sets in almost directly after the exercise phase begins and is lastingly retained even during continuous training.

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# Chapter 2:

## Cycle Selection, Clothing and Equipment
## (“fit your bike”)

**Cycle selection, clothing and equipment ("fit your bike")**

In order to have fun while cycling and to notice the enjoyment, the choice of bike type is decisive and the bike equipment is also extremely important. Because the fund only starts if the cycle meets the requirements and also satisfies the anatomical and physiological conditions. In particular, comfort, which is important to feel under health aspects, only sets in if not only the suitable frame size but the contact points between man and bicycle – i.e. the handlebars/the handles, the saddle and the pedals are optimally matched to the individual prerequisites and needs. From the large number of products available, the right ones must be found which promote comfort and do not impair health.

These must therefore satisfy the following standards:

- Individuality (body mass, etc.)
- Ergonomics/functionality (anatomy/health)
- Differentiation (area of use, requirements)
- Safety

Fun and enjoyment are only obtained if all this fits and only so will the bicycle become that which it can be – the motor for a healthy and fulfilled life!

## 4. Bicycle types

### 4.1 Road Racing Bike

**Characteristics**: Sport orientation, speed, asphalt roads, alternative training for MTB riders, "excursion", discover the environment, for active people, almost no age limit, group excursions, 28 inch tyres, narrow tyres, 16 – 20 gears, sports equipment, no protective plates (mudguards), light or luggage rack, racing bars

A racing bike is identified by its very thin tyres with a 28 inch circumference and racing handlebars. It has 16 – 20 gears. The fitout is very Spartan. Only that which is necessary it added on. Therefore a racing bike has no mudguards, luggage rack or light machine. This means that it is not roadworthy (i.e. safe in traffic) according to the road traffic regulations. However, due to the special fitout it is the lightest type of cycle on the market. The total weight lies between 7 and 10 kg.

Due to the narrow and profile free tyres, it is primarily for use on paved surfaces.

The rolling and air resistance is very low. This, combined with up to 20 gears, makes the racing bike the “fastest cycle”. Downhill, it can easily reach speeds of over 50 kilometres per hour.

The rider’s position on a racing bike can be called very sporty. The low racing handlebars causes the upper part of the body to be bent far forward, in order to give the wind as little contact and resistance area as possible. At the same time, this also determines the type of rider. People who use a racing bike are mainly sporting people, as the muscular exercise is also correspondingly “sporty”.

Fig.1: Road Racing Bike

Due to the circumstances of a racing bike, long excursions lasting several hours (50 – 150 km) are not rare. This means large landscaped regions can be explored under a person’s own power. Racing cyclists love the almost soundless exercise and speed, which can be experienced with a racing bike. For sporty people there is hardly any age limit for riding a racing bike.

Racing bike riders travel relatively frequently in groups, which creates a feeling of group belonging. This is most frequently reflected in membership of a cycling sports club.

## 4.2 Mountain Bike (MTB)

Characteristics: Varying exercises, diverse possible uses, stable, 26 inch tyres, wide tyres, cushioning springs (suspension), comfortable due to suspension, 27 – 30 gears, no mudguards, light or luggage rack

Nowadays an MTB is either identified by a front suspension in the sense of a spring fork (“Hardtail”) or full suspension in the sense of a rear wheel and front wheel suspension (“fully”). It is equipped with 24 – 27 gears and usually has neither a light machine or a luggage rack. The 26 inch tyres are highly profiled and wide. This ensures good traction even on loose and/or muddy ground. The MTB can also be ridden on tarred roads and can thus be used on any terrain.

Fig.2: Mountain Bike

However, it best feels at home on unsurfaced paths with inclines and descents. The large number of gears combined with the thick tyres make steep inclines and descents in the terrain possible. Therefore the MTB is built very robustly, so that all the forces that act on it, which occur on poor ground and/or during jumps, can be tolerated by the material.

It was originally developed as a piece of sports apparatus, but is now used almost everywhere due to its versatility. Which is why trekking/city bikes or touring bikes are often based on mountain bikes. The MTB is therefore interesting for each “cyclist” target group. In order to enjoy the pleasure without disruption and to minimise stresses for the passive skeletal systems, the MTB should always be equipped with good suspension systems.

### 4.3 Fitness or Hybrid Bike

Characteristics: Unites the advantages of a racing bike/MTB, 28 inch tyres, straight handlebars, derailleur gears, joy in exercise, asphalt roads, outdoor exercise, comfortable but sporty sitting position, sport machine, no light

Fig.3: Fitness or Hybrid Bike

The fitness bike unites the sportiness and speed of a racing bike with the robustness of the mountain bike. It is equipped with 28 inch tyres and straight handlebars. It is driven by derailleur gears with 24 – 27 gears. It has no mudguards, light machine nor a luggage rack. It is therefore not fully roadworthy and must therefore be seen as a pure sports machine. The frame geometry with the straight handlebars and in conjunction with an adjustable front stem enables a sporty but nevertheless comfortable sitting position. Combined with the large number of gears this enables large includes and descents to be mastered. The fitness bike is designed for paved forest and field paths as well as for roads. It is a cycle for anyone, who enjoys exercise in the natural countryside. The relatively comfortable and adjustable sitting position makes it useable for the majority of the population as a sport and fitness machine and it is therefore accessible to the broader masses than for example a racing bike or mountain bike.

## 4.4 Trekking Bike

Characteristics: combination of racing bike/MTB, roadworthy, 28 inch tyres, alternative to a car, relatively upright seating position, all-round bike

The trekking bike is a combination of a racing bike and mountain bike. However, it is roadworthy and has a light machine, luggage rack and mudguards. This means it is used on the one hand as a travel bike or transport bike in everyday life, but also as a sport machine, for example in order to make a day tour at the weekend. It either has derailleur gears with up to 27 gears or smooth-running hub gears. The 28 inch tyres are slightly profiled, so that the rolling resistance on roads is kept low, but also exists on unpaved paths (e.g. sand) due to their grip. This means it is frequently used as an alternative to a car. The sitting position is relatively upright. This makes the trekking/city bike and all-round cycle for a more “pleasure” oriented cycling group.

Fig.4: Trekking Bike (Men’s)

Fig.5: Trekking Bike (Women’s)

Trekking bikes are often available with men’s and momen’s frames, but more and more often the trekking bike is a unisex.

## 4.5 City Bike

Characteristics: solid transportation bicycle, to ride in a very comfortable upright position; normally available in men's and women's specific frames

The city bike is the evolution of what we normally call "the bicycle" for transportation use. Available in men's (fig.6) and women's (fig.7) specific frames, city bikes are much more comfortable than commonly associated with cycling.

Modern models have gears, good saddles and grips, adjustable seat posts and handlebars and and many other details which make them a good substitute to cars in the urban commuting.

Fig.6: Men's City Bike

Fig.7: Women's City Bike

## 5. Inspection and Maintenance

Before cycling the bike must always be inspected, this means visually inspecting the wheel mechanisms for defects.
A “major” inspection should also be carried out at least once a year. This can either be carried out themselves by experience cyclists with special tools. But in most cases the bike should be taken to a specialist for the following.

- Check bearing slack (pedal bearings, front wheel, rear wheel, controls)
- Check all screws and if necessary tighten with the correct torque
- Check running wheels for “true run” and centre if necessary
- Pump up tyres to correct air pressure
- Adjust gear changes
- Adjust brakes
- If applicable, check light machine
- Renew any worn materials (chain, pinion gears, sleeves, hoses, handlebar tape/handles, brake pads, brake/derailleur cables)
- Test run to discover any defects during the trip

### 5.1 “Do it yourself”

These activities should be able to be carried out by each rider themselves, without a great deal of specialist knowledge.

- Clean bicycle and check the loose parts, tighten if necessary or give to cycle dealer
- Pump up tyres

**Tab.3: Tyre pressures in various types of bicycles (dependent on the tyre thickness, as well as other things)**

| Cycle type | Racing bike | Fitness bike | Trekking/City bike | Mountain bike |
|---|---|---|---|---|
| Air pressure in bar | 6 - 9 | 4 - 6 | 2 - 5 | 2 – 5 |

## 6. The correct frame size

The correct frame size is frequently decisive for fitness and performance, as can be seen from the example of the Tour de France professionals. For top performance sportspersons, perfect adjustment to the sports equipment is elementary. Each leisure and health sportsperson also profits from the correct frame size. Apart from the performance, it results in a greater feeling of well-being and more comfort while cycling. The most important criteria for the correct frame size are the following aspects:

- Size and anthropometry of the cyclist
- Type of use

One main rule is:

***The larger the sportsperson, the larger the bicycle.***

As the size of the frame is denoted by the two measuring points: saddle height and handlebars-saddle spacing, depending on the type of use, there are considerable differences. The frame height only plays a subordinate role due to the sloping geometries (falling and therefore shorter seating tube). Especially for very sporty riding methods, a lower frame height is often chosen as this makes the whole cycle more manageable and manoeuvrable.

### 6.1 Finding the classic frame size

In a classic frame shape the correct frame height is determined using a simple rule. To do this the rider places the bicycle or top tube between their legs. When both feet are on the ground, the top tube should just escape touching the crotch. The following formula can also be used to calculate the frame height. To do this, the inside leg length is multiplied by the factor 0.65.

***Classic frame height (in cm) = inside leg measurement (in cm) x 0.65***

Sloping frames are now offered for all bicycle types. These can be identified by their top tube which slopes away to the rear so that the seat tube is 5-12 cm shorter than in a classic frame.
The frames are usually square, so that the frame length corresponds to the frame height.

***Frame length = Frame height***

This classic standard applies above all to the racing bike. Although new alternative size recommendations now exist due to different seat positions and handlebar forms. In the classic frame size individual differences are usually corrected by adjusting the saddle and the handlebars. The following basic rules apply to this:

- The more sporty the riding the longer the frame can be
- If comfort is important a shorter frame is chosen
- A shorter frame is chosen for technical mountain bike disciplines (DH, FR, Trial)
- Women choose a shorter frame as this often results in better handling of the cycle and thus to more fun and well-being

The length of the frame can therefore vary by up to 10% (+- 2-3 cm).

## 6.2 Determine the exact frame length

A more exact determination of the top tube length can be calculated using a somewhat more complicated method. To do this the reach of the rider must be calculated. This is done using the following formula:

***upper body length + arm length = reach (all in cm)***

The upper body length is determined using the shoulder height (floor to height of scapuloclavicular joint) less the inside leg measurement.

***upper body length = shoulder height – inside leg measurement (all in cm)***

The arm length is determined from the scapuloclavicular joint up to the middle of the fist of the stretched out arm.

The top tube length now results from the seat length minus the front stem length.

***top tube length = seat length – front stem length (all in cm)***

The front stem length is often changed again for the following uses. For touring and technical mountain bike disciplines (DH, FR, Trial) the lengths given above are shortened by 30-60 mm. With simultaneous displacement of the handlebars upwards, the rider has a more upright position, which often leads to more comfort (especially in people with weak back musculature or complaints).

The seat length is determined with the following table:

**Tab.4 : Reach, seat length and front stem length**

| Reach in cm | Seat length in cm | Front stem length in cm |
|---|---|---|
| 970 | 625 | 90 |
| 1020 | 645 | 95 |
| 1070 | 655 | 95 |
| 1120 | 670 | 100 |
| 1170 | 690 | 100 |
| 1220 | 710 | 105 |
| 1270 | 715 | 110 |
| 1320 | 730 | 115 |
| 1370 | 740 | 120 |
| 1420 | 745 | 125 |
| 1470 | 760 | 130 |
| 1520 | 780 | 135 |
| 1580 | 790 | 140 |
| 1630 | 805 | 145 |
| 1680 | 815 | 150 |

## 7. Saddle and handlebar adjustments

In order to have real fun cycling, it is important to individually and optimally adjust the bike to the body mass.

### 7.1 Saddle and seat height

The selection of the right saddle is a critical one, because 60% of the cyclists feel discomfort. This happens both to men and women, both to recreational and sportive cyclists.

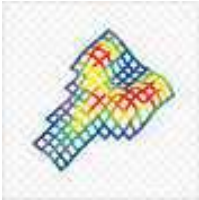


Fig. 8

Every person has a different anatomy, so there is no saddle which can suit to everybody. Moreover cycling can be undertaken with a variety of different bicycles, whose geometry influence the position of the cyclist on the saddle. Nevertheless we can state that on each saddle the pressure location is mainly on three points: the genital area in the front central part of the saddle and the sit bones area in the rear left and right parts, as can be seen in fig.8. The high pressure on these 3 points generates what the cyclist experiences as discomfort or pain.

To experience comfort instead of pain and make cycling a more pleasant experience, the saddle has to allow good pressure distribution. This means minimizing the high pressures on the delicate genital area and on the sit bones by distributing it over a greater contact area.

The variety of saddles available on the market nowadays is almost confusing for the inexpert, but in general terms we can divide the saddles in 3 categories, depending on the sitting position of the cyclists


Fig. 9a: Race

Sportive Saddle: A mountain biker or road racer sitting in a very forward-bent position puts more pressure on the genital area. The saddle is quite narrow on the rear, because not a lot of weight is positioned there.


Fig. 9b: Trekking

Trekking Saddle: A trekking or recreational cyclist normally sits in a slightly bent forward position, but not as extreme as a sportive cyclist. Therefore the saddle needs to be a bit wider to allow better support to the sit bones which touch the saddle.


Fig. 9c: City

City Saddle: The cyclist on an upright position, like on a city bike, puts most of the pressure on the rear of the saddle, which needs to be very wide to allow good support to the sit bones.

In explaining this concept we used as examples the type of bikes used by the cyclists, but it is not the type of bike which determines the saddle, but the position of the rider on it.

The anatomy of the person is also very important. For each type of saddle (sportive, trekking or city) there are different sizes. The simplest distinction on the size can be identified with men's and women's saddles. Normally the first are narrower, the latter wider and more T-shaped, because women have wider sit bones than men, as can be seen in Fig.10.


Fig.10: Men's and women's sit bones sizes.

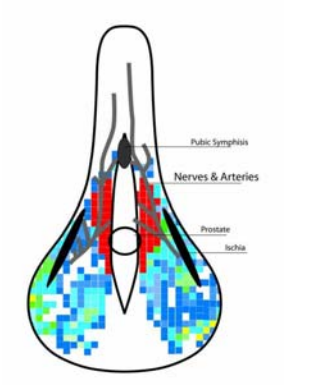



Fig. 11a: Men's genital compressed by a saddle with a hole

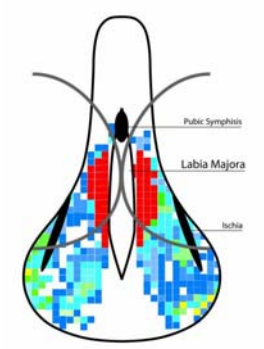



Fig. 11b: Women's genital compressed by a saddle with a hole

Last, but not least, a variety of shapes of saddles and type of paddings is available on the market. In term of shapes saddles range from very flat ones to slightly anatomic, to those with a hole in the genital area. This last type of shape is very controversial. The hole in the middle should relieve pressure on the genital area, but in fact all it does is moving pressure from the center to the sides of the hole. This could cause compression of delicate tissues both in men (genital nerves and arteries, Fig.11a) and women (*labia majora* or outer genitals, Fig.11b), as can be seen in the illustrations.

Once established if the cyclist prefers a flat or a slightly anatomic saddle, the difference in terms of comfort is given by the type of padding material. Gel is certainly the best material, because not only it allows pressure distribution, but also shock absorption. Some types of gel available in the market allow a reduction of the high pressures on the delicate genital area by 50-80%, as can be seen in the illustrations comparing gel and non gel saddles (Fig. 12a and Fig. 12b).

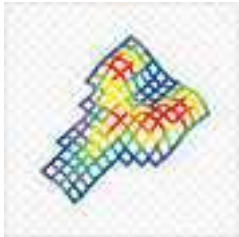


Fig.12a: Normal Saddle

Fig.12b: Saddle with Gel

If the cyclist experiences discomfort, then, the first thing he should look at is the saddle. He should select the saddle with the appropriate padding (ex. gel) and the

right dimensions, depending on the style of riding (sportive, trekking or city) and on the sex (men or women) and physical build.

Once established that he has chosen the best saddle, the cyclist has to adjust it properly on the bike. The saddle should be set parallel to the ground so that its tip is not pointed up or down to any great extent (see Fig. 13). In case of slight pressure problems the tip of the saddle can be tilted forward a little.

Fig. 13: Horizontal saddle

In order to avoid overstraining the knee, the seat height should be adjusted so that the rider can just still reach the ground with the tips of their toes when sitting on the cycle. If the cyclist feels unstable, the saddle can be set slightly lower. This is also often the position used by mountain bike riders (e.g. Trial, Downhill). In the riding situation the leg is always slightly bent. A simple setting is the heel method, in which the heel is placed on the pedal in the lowest point. The leg should then be able to be stretched out. During normal riding the balls of the feet are on the pedal, which means that slight bending is guaranteed even in the lowest position. A scientific method of calculating the optimum seat height is the so-called method using the “Hügi formula”. This is calculated by multiplying the inside leg measurement by 0.88. The inside leg measurement is determined by measuring the length of the inside leg. The saddle is then adjusted from the centre of the pedal bearing axis with its top edge set at this determined dimension.

Fig. 14: Plumb saddle tip – pedal bearings

The saddle is usually fitted in the middle above the saddle support. This guarantees that the saddle lies behind the pedal bearings and apart from optimum force transfer this also guarantees a comfortable seating position (see Fig. 7b). A precise method consists of allowing the plumb line to fall from the knee cap in a sitting position. Then, with the crank set horizontal (to the from) allow the plumb line to fall through the pedal axis.

## 7.2 Handlebars

When gripping the (top) handlebars the hand should form an extension of the arm so that there is no major kink in the wrist and therefore any incorrect loading is avoided. Handlebars which are slightly bent backwards (8-12 degrees) are best suited for this because this places the hand in an anatomically compatible position. This prevents stretching muscles and nerves on the outside of the hand and reduces the unpleasant tingling.

The height of the handlebars is below or at the same height as the seat for sporty riders. For a pleasurable seating position it is advisable to set the handlebars higher than the saddle.

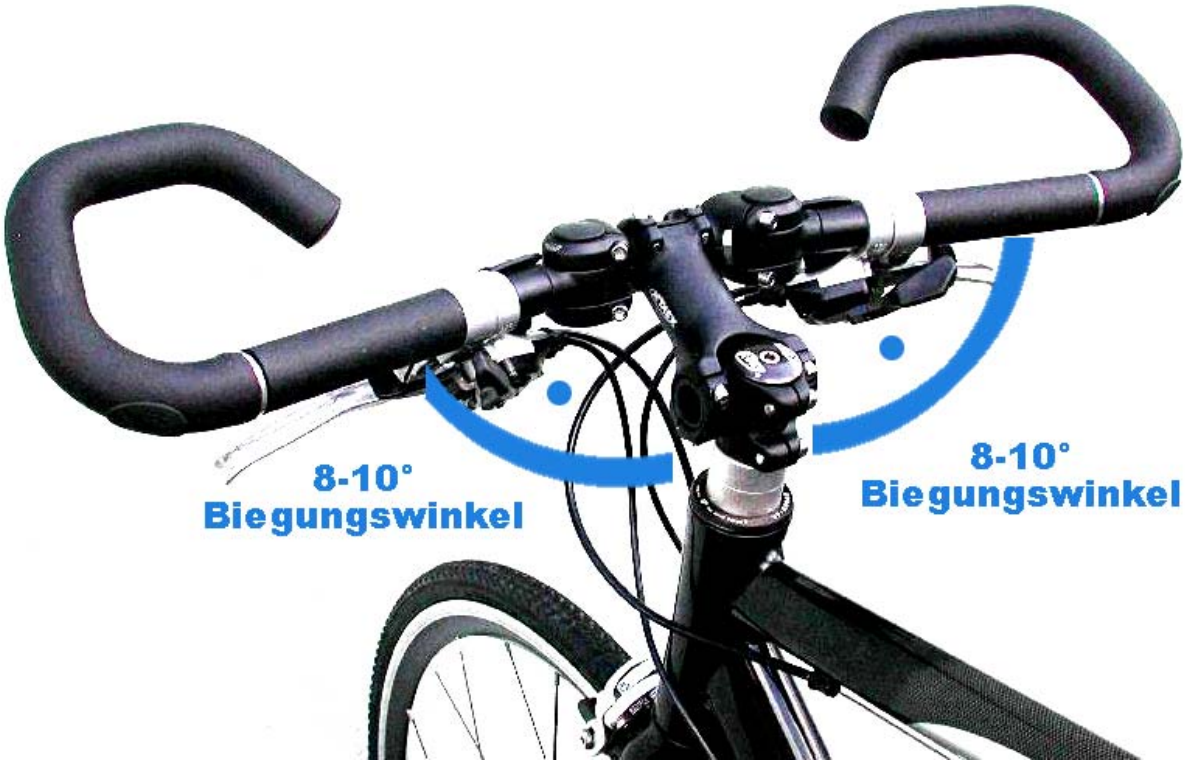



**Fig.6: Ergonomically curved handlebars**

*(Bild: Biegungswinkel = deflection angle )*

On a **racing bike (racing bars)** the handlebars should be set so that a comfortable position can be achieved at the top of the handlebars. The distance between the handlebars and saddle must be chosen so that when the racing bars are gripped below, when looking down on the front wheel hub the handlebars conceal it. A further method is to determine the distance between the tip of the saddle and the

handlebars. This should be approx. equal to the length of the forearm + 2-4 fingers. The precise value is given in Table 4 (page 58).

The **MTB/trekking bike (cropped handlebars)** handlebars should be able to be comfortably reached, although the rum should be slightly bent forward. This distributes the weight of the rider to the arms. Any bar ends (handlebar “horns”) should be set so that they point to the front, with an upward angle of 20 – 30 degrees. The brake lever should be fitted slightly downwards, so that the fingers only have to be stretched out to reach the lever.

### 7.3 Handles / Handle tapes

The material of the handlebar handles should sit comfortably in the hand and be slip proof. In order to reduce the strain on the hand and forearm due to resting on them, the handles should be anatomically shaped. This means that they should trace the anatomical shape of the hand and must support the “hollow hand” formed when the hand is supported by the handlebars. This is best guaranteed by handles which are considerably thicker in the middle and have a “belly”. As hand sizes and shapes vary greatly, each person must find the right handle for them.

The fine carriageway unevenness can be very well dampened by a padded handle or handlebar tape. E.g. this can be achieved by using gel inserts.

**Fig. 16a: “Bellied” handle**

**Fig. 16b: “normal” handle**

## 7.4 Pedals

On the one hand the pedals must take up the force from the legs without loss and transfer this into movement and on the other they must support the feet without impairing the movement of the joints. They must be slip proof and enable an adequate standing area.

Under health aspects it is particularly important that the pedals do not impair the movement of the knee joint. This is guaranteed if the feet have a relatively free movement on the pedals. So-called “cages” are therefore not suitable, because the feet are fixed and immobilised in them. Modern click pedals should therefore permit a movement of 6-8 degrees on both sides of the foot so that the up and down movement of the knee joint can take place without obstruction. The cleat should sit directly under the balls of the feet (large toe base joint), because this is where the force is best transferred. The precise position is also a matter of taste to a certain extent. The angle of the cleat beneath the shoe must be directed by the natural position of the feet: the feet point parallel to the front.

## 7.5 Suspension systems

Suspension systems (spring cushioning systems), which can nowadays be found on almost all bikes – except racing bikes – serve to reduce the strains due to the ground on the supporting and musculoskeletal system and to increase enjoyment. In particular, this relieves the so sensitive back with its really “weak” muscular protection. Suspension systems are most important at the saddle or the rear construction because this directly spares the spine. Scientific studies show that sprung saddle supports reduce strain by up to 25%, while fully sprung wheels can even improve impact absorption by up to 35%. However the setting and quality of the spring is an important prerequisite. The system’s benefits can only be exhausted if this is matched to the body weight, the terrain requirement and the method of riding.

Modern systems allow a relatively simple adjustment to be made, which can even be changed during the ride.

Under health aspect the front suspension is least important, however it can considerably increase riding fun and especially under safety aspects can be very purposeful because as a result the front wheel can maintain ground contact even in difficult terrain.

Saddles can also absorb part of the impacts. Foam, rubber or gel can be used as the spring cushioning element.

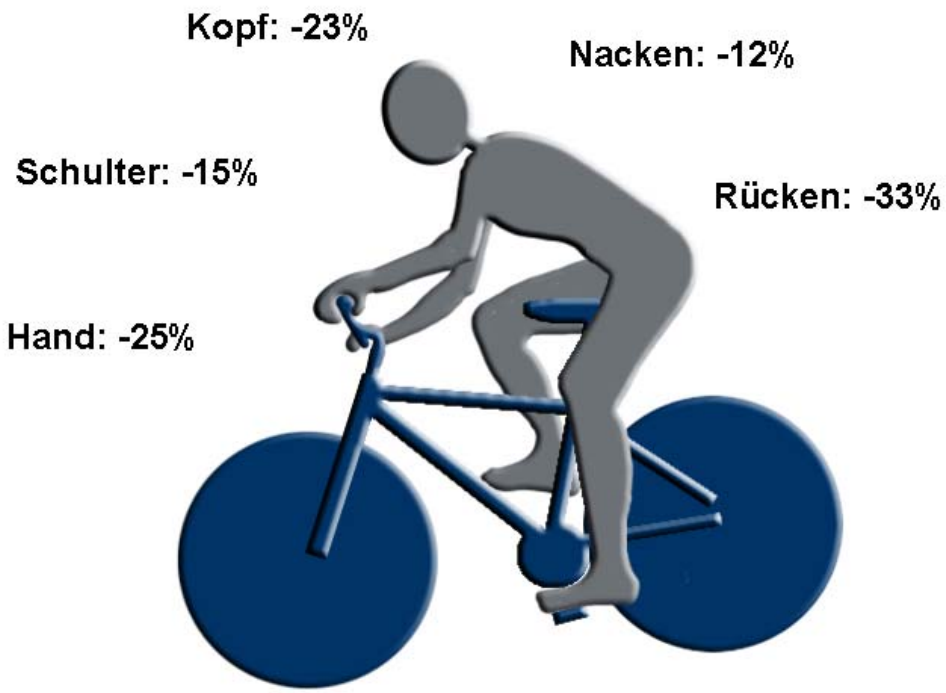



**Fig.8: Vibration reduction through spring fork / frame suspension**

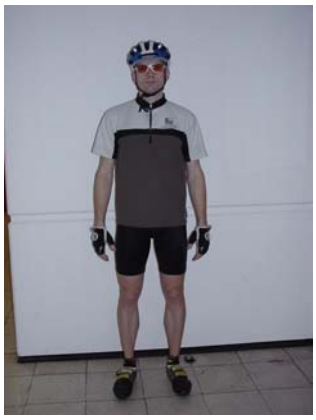
*Kopf = head, Nacken = neck, Schulter = shoulder, Hand = hand, Rücken = back*

## 8. Cycling clothing

To prevent possible problems while cycling, it is also advisable to pay attention to the correct clothing. A differentiation can be made between a leisure cyclist and an ambitious hobby cyclist

**Tab.5: Cycling clothing**

| Leisure | Ambitious |
|---|---|
| ▪ Loose cycling trousers (d, e) (possibly with insert) | ▪ Close-fitting cycling trousers, long and short (a,b) |
| ▪ Permeable to the air casual shirt (a, e) | ▪ Functional shirt and cycling tricot (b) |
| ▪ Shoes with relatively firm soles (d, e) | ▪ Cycling shoes (a – c) with click pedals |
| ▪ Cycling gloves (short and long) (a – c) | ▪ Cycling gloves (short and long) (a – c) |
| ▪ Cycling helmet (a – e) and cap | ▪ Cycling helmet (a – e) and helmet cap |
| ▪ Outer rainproof clothing (d, e) | ▪ Cycling goggles with orange (a – c) and dark lenses |
| | ▪ Permeable to the air rainproof trousers, jacket (c, d) and overshoes |



**a**

**b**

**c**

**d**

**e**

**Fig.9a-e: Cycling clothing**

## Minimum clothing

Even if the cycle is only used for short routes and for errands, attention should be paid to wearing clothing permeable to the air and in particular to firm footwear without heels. Goggles protect the eyes and gloves warm and protect against hand injuries in a fall. Helmets should be obligatory anyway – even for short trips!

# 9. Equipment

## 9.1 Bike accessories:

Each cycle owner should have the following bike accessories. On the one hand they are used for maintenance and safety and on the other they can be used to correct minor defects.

- Lighting (MTB/racing bike)
- Push-in guard (MTB/racing bike)
- Silicon spray/chain oil
- Padlock

## 9.2 Accessories bag

- Tyre repair kit
- Tyre lever
- Spare hose
- Air pump
- Mini tools

# Chapter 3:

## Fit and Healthy with Training Programmes for Everyone (“Get fit on your bike”)

## Fit and healthy with training schedules for everyone ("Get fit on your bike")

Health and well-being are directly linked to the psycho-physical functions and their capability. Performance can only be stabilised or even improved through training and exercise. As functions and capabilities constantly change during the course of a life and the environmental conditions frequently result in under or over demands on the individual human systems, specific counter measures are purposeful and necessary. These can be summarised under the main heading of "training", in which training can have an effect on both the physical and the psychological functions. The basis of health-oriented action is thus the individually matched implementation of exercise situations, which maintain the systems, functions and capabilities or increase them through fitness. In particular, the "how" of training is decisive and not the "what". Therefore a differentiated application of activities, such as cycling, must be undertaken in order to achieve a positive effect with the training effort. This can certainly also include training, which would not be normally included. Physical activities of everyday life can also achieve health effects and are thus also to be viewed as being training. Because in most cases it is not the quantity but solely the quality which is the key to success!

## 10. Principles of Correct Training

From a physiological point of view, training is to be considered a constant adaptation effect to exercises (training stimuli).

By setting a training stimulus the body's biological equilibrium (homeostasis) is disturbed. The body adapts itself to the exercise after the subsequent recovery (regeneration) and achieves a higher performance level (super compensation) than before the stimulus was set.

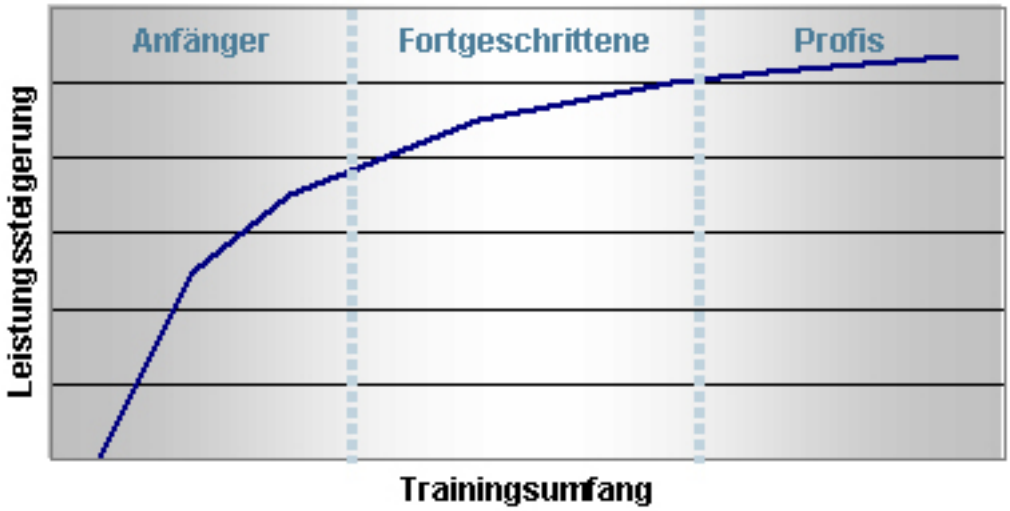



**Fig.10: Performance growth through training**

*Leistungssteigerung = Performance increase, Trainingsumfang = Extent of training, Anfänger = Beginners, Fortgeschrittene = Advanced Profis = Professionals*

Depending on the goal of the training, the training stimulus can vary. Specific stimuli cause specific adjustment reactions. Depending on the type of performance, characteristic adjustment effects result in the neuromuscular (coordinative) or in the energetic (conditional) area.

It is important that the next training stimuli is set at the highest point of the super compensation. The basis for a following growth in performance is then specified on the new starting level. Breaks are therefore important, so that the body can recover and in order to exhaust the training effect.

If the training is set too early in time, it is possible for the performance to drop. If the time chosen is too late, the performance level stagnates and there is no new growth in performance.

The development of the training condition is very rapid at the start of training and then becomes slower and more difficult. If a high performance level has been reached, the performance leaps reduce. Ultimately a plateau forms, at which a constant performance level can be maintained. This is the reason why high-performance cyclists must use a very high extent of training and differentiated

training schedules, in order to be able to improve their performance level still further or even to only maintain it.
However, for beginners and less trained persons this means that they can achieve large increases in performance with relatively little effort and the associated health effects are also possible.

The following physical capabilities can be trained:

- Stamina /endurance
- Power/strength
- Speed
- Mobility/agility
- Coordination

**Tab.6: Motoric capabilities and every day benefits**

| Capabilities | Everyday benefits |
|---|---|
| **Stamina** | ▪ Improved general fitness,<br>▪ Prevention of cardiovascular risk factors,<br>▪ Strengthening the immune system,<br>▪ Positive effect on the psyche (even temperament). |
| **Strength** | ▪ Marked muscular corset protects against dysbalances,<br>▪ Marked muscular system increases energy turnover under conditions at rest - consequence: Do not put on weight as quickly. |
| **Speed** | ▪ Improved reactions and thus fall prophylaxis as appropriate action can be taken in the respective situations. |

| Capabilities | Everyday benefits |
|---|---|
| **Coordination** | ▪ Cycling trains the coordination and thus the “physical feeling”. Reactions to unforeseeable situations in every day life are improved and the body can be better kept in equilibrium (e.g. when avoiding an object) |
| **Mobility** | ▪ Mobilisation of the large main joints results, e.g. knee, hip and shoulder joint.<br>▪ This is very important as an compensation especially for people who sit at work. |

Different development potentials exist within the conditional capabilities. For example speed can only be increased to a small extent (10-15%). Power and stamina (up to 100%) on the other hand can be influenced to a greater degree.

## 10.1 Exertion or exercise criteria

### Training intensity

Training intensity is understood to be the strength of a exertion or exercise due to a exercise stimulus or due to a training unit. The intensity is most easily controlled using the pulse.

**Training extent**

The extent of training is formed by the sum of all the exercise or training stimuli within a training unit or within certain training sections (weeks). In the case of cycling this is to be equated to the kilometres ridden or the length of training.

**Exercise density**

Exercise density is understood to be the time relationship between exertion and recovery phases (pauses).

On the one hand this can be from one training session to the next, on the other it can also be the pause between the individual exercise intervals.

**Exercise period**

The exercise period gives the length of time during which an individual stimulus or a series of stimuli acts on the organism.

**Training frequency**

The training frequency stands for the number of training units per day or week.

**Regeneration**

Apart from training exercise the regeneration (recovery) of the strained structures is part of the successful training schedule.

Roughly expressed, the following statement applies:

***The more intensive the training was, the longer the organism needs to regenerate.***

Regeneration processes are understood to be the reinstatement of the metabolic and morphological structures which have been imbalanced by the training. The regeneration lasts until all the “repair work” has been completed.
Diseases and colds influence the regeneration mostly in the form of longer intervals required by the body to reach equilibrium again.

Favouring factors for regeneration are, among other things,:

- Adequate rest – no unnecessary additional stresses or strains, adequate sleep.
- Diet – carbohydrate, vitamin and mineral rich, in order to top up the consumed energy reserves again.
- Massage – reduction of the muscle tone
- Hot(s) bath or shower, sauna – boosts the metabolism and relaxes the muscular system.
- Relaxation techniques

Favouring factors for fast regeneration is their active support (regenerative training, stretching, cool down). These aim to achieve faster transport of the metabolic waste products from the muscular system.
Among other things, the length of time required for regeneration depends on age, sex and training condition.

A sure sign of completed regeneration is the physical feeling during the next training. Further, a positive attitude, the urge for exercise, good sleep and appetite, normal cardiac frequencies at rest and under exercise are all signs of completed regeneration.

## 10.2 Training methods

There are many different training methods. For health the continuous method or – if little time is available – the interval method.

### Sustained method

The sustained method (endurance training) is used to train the very important basic stamina. Several important health promoting effects are attributable to this:

1. **Increasing physical fitness:**
   - ➡ Tiredness can be better tolerated. The result is that the body can maintain its performance longer.

2. **Optimisation of the ability to recover:**
   - ➡ Fatigue substances arising are eliminated from the body quicker. This enables the body to regenerate more quickly after stresses or strains.

3. **Minimisation of injuries:**
   - ➡ Due to the later onset of tiredness the risk of injuries due to tiredness is reduced. The central nervous system and as a result the reflexes are not tired and slowed down so quickly. Thus the protective function can be retained longer in the form of fast and decisive reflex actions.

4. **Increasing the ability to withstand psychological stress:**
   - ➡ People who have had endurance training have a higher resistance to stress and a higher psychological stability. Failures can be better coped with due to a more positive basic mood.

**5. Constant higher reaction and speed of action:**

- Due to the improved ability to recover and the associated smaller accumulation of fatigue substances, the capability and efficiency of the central nervous system is less impaired.
- As a result, perception, decision-making and speed of action are maintained as important prerequisites for optimum speed of action.

**6. More stable health:**

- To a certain extent, endurance training "hardens" people. The immunological defence situation improves and infection diseases such as coughs, head colds and flue can be better warded off.
- In addition, basic stamina has very many preventive effects for cardio vascular diseases and illnesses resulting from a lack of exercise. This is the most important of all in health-oriented sport.

The following sustained training methods can be used:

- **Continuous method:**
  This is characterised by a constant intensity. It is the main training method in cycling. Given an appropriate intensity, the main aim is to improve aerobic capacity.

- **Alternating method:**
  At previously determined sections of the route the speed is increased during an intensive training area.

- **Trip allowance:**
  In this form the training speed varies and is adapted to the terrain. The variation in speed results in training in different intensity areas.

**Interval method**

The interval method is characterised by a scheduled change from exertion and relief. The exercise intensity is mostly very intensive. Therefore it is mainly aimed at strength capabilities, such as elasticity/springiness and strength stamina, as well as speed.

The recovery interval does not last up to complete recovery (rewarding pause). The new exercise interval is started with a pulse below the range of the basic stamina. The length of the pause varies depending on the type of training stimulus.

Depending on the length of the interval, the interval method is differentiated into:

- Short-term interval (7-60sec.)
- Medium-term interval (1-3min)
- Long-term interval (3-15 min)

The extensive interval method is intended to shift the anaerobic threshold upwards, as well as to improve aerobic capacity and anaerobic mobilisation.

The intensive interval method improves lactate tolerance and regenerative capability for short, high exercises. The effect of this method on health is of course limited. But persons who only have little time available or who only use their cycle during everyday situations also profit from it as the body quickly shows evidence of adapting.

## 10.3 Planning the exercise

In order to optimally plan the effect of the training and to achieve maximum health benefit, it is necessary to coordinate the exercise periods and intensities. The content is aimed at the personal prerequisites, the time budget, the goals and wishes as well

as the environmental conditions. Under health aspects the basic stamina with its additional positive effects naturally plays the dominant roll in all planning.

If little time is available or if the cycle is only used in everyday routine, the interval method can or should be used, as somewhat more intensive exercises in a short time give a better effect.

If a fundamental and sustained fitness improvement is the aim, it is purposeful to plan in periods and to vary the training according to the season.

The starting level is decisive for training and health relevant stimulus. Beginners necessarily exercise differently to persons who are already trained for endurance. It is never too late to begin, because done correctly and above all slowly the positive results can soon be seen and felt.

**Tab.7: Orientation values for the exercise intensity (after Lagerström,1995)**

| | 60% | 60-65% | 65-70% | 70-75% | 75-80% |
|---|---|---|---|---|---|
| **Untrained** | * | | | | |
| **Moderately trained** | | * | | | |
| **Trimmers** | | | * | | |
| **Performance oriented trimmers** | | | | * | |
| **Competitive sportspersons** | | | | | * |

Exercise intensity figures in % of maximum heart rate (HF) (max. HF = 220 – age).

## 10.4 Training programme

In order to optimally exhaust the training effect due to cycling for the health and well-being, it is necessary to take into consideration the individual prerequisites and the training progress of all the physical systems. Training of beginners thus has a different character to training of the advanced. We therefore recommend that a programme be setup in three exercise stages, where beginners have to through all while the advanced can enter at a higher stage according to their capability. We differentiate between the following stages:

- Adaptation phase
- Development phase / preparation phase
- Stabilisation phase

### Adaptation phase

It is best for beginners and persons with poor stamina or endurance training to begin first with light cycling and to gradually get used to the exercise. This adaptation phase, which should usually last for four to six weeks, provides the best prophylaxis (preventive measure) against the frequently occurring muscle and joint paints experienced at the start of training. The actual training can only be started when the body has adapted itself to the unfamiliar exercise.

**Tab.8: Adaptation phase**

| | |
|---|---|
| Objectives | Achieving metabolic adaptation, improving metabolism.<br>Economy of movement, psyche |
| Methods | Sustained method, very low intensity |
| Intensity | 50-60% of the max. heart rate |
| Duration | 20-40 minutes – 50% of the resilience to stress and exercise leading to exhaustion |

**Development phase / preparation phase**

When beginners have finished their adaptation phase, development of the psycho-physical fitness begins. Advanced persons can start their training with this phase straight away. The aim is to improve the general and cardiovascular capability, as well as increasing the economy of movement. In this section the person must try to use the basic stamina to develop the physical characteristics for training during the following months and years. Ambitious sportspersons usually carry out this training phase during the winter and spring and thus create the basis for the summer. This period is also ideal for tour cyclists in order to prepare for longer excursions during the summer.

**Tab.9: Development phase / preparation phase**

| | |
|---|---|
| Objective | More special development of the basic stamina, increasing the aerobic capacity, fat metabolism training, cardiac functions, psychological stabilisation |
| Methods | Sustained method, trip allowance, possibly extensive interval method |
| Intensity | 60-85% of the max. heart rate (depending on the objective) |
| Duration | 20-90 minutes |

**Stabilisation phase**

During the stabilisation phase efforts there are increased attempts to set the emphasis for permanence of the health effects. This is the actual section which stabilises health, compensates for any changes due to age that may occur and ensures good capability and functionality through to old age. Irrespective of whether the cycle is used in the everyday routine or specific tours are carried out, in this phase it is important for the training or exercise to be applied long-term and regularly. The health success only sets in and above all is only retained if the bicycle becomes a constant companion.

**Tab.10: stabilisation phase**

| | |
|---|---|
| Objective | Aerobic, aerobic-anaerobic and anaerobic metabolic improvement, preparation for performance oriented training |
| Methods | Sustained method, trip allowance, repeat method, extensive and intensive interval method |
| Intensity | 50-95% of the max. heart rate |
| Duration | 20 – 120 minutes |

## 11. Healthy Cycling for Various Target Groups

Cycling has a large number of positive health effects for people (see Chap. 1). However, the objectives differ due to certain factors, such as age and sex. In various age groups, specific health goals occur, complaints or diseases are particularly in focus, so that the following table describes the main aspect for each target group. However, this table is only for orientation, so that in the individual cases the named preferences or advantages can also be assessed in another form. In general, regular cycling in everyday life provides the possibility for bringing about a change for most health topics. However, this can usually be achieved far more effectively through specific training, which is why both are best combined with each other.

**Tab.11: Main aspects of healthy cycling in various target groups**

| | | **Cycle use/Goal attainment** | **Mobility / Regular everyday use** | **Leisure sport** |
|---|---|---|---|---|
| **Age in years** | **Sex** | **Main aspect of healthy cycling** | 20 min / day | 60 min / TU |
| ***20-30*** | Female | Body shaping | ++ | +++ |
| | Male | Fun, action | + | +++ |
| ***30-45*** | Female | Fat metabolism | ++ | +++ |
| | Male | Relaxation | + | +++ |
| ***45-60*** | Female | Immune system | + | +++ |
| | Male | Cardiovascular prevention | + | +++ |
| ***60 +*** | Female | Skeletal system | + | ++ |
| | Male | Anti-aging | ++ | +++ |
| +=suitable, ++=well suited, +++=very well suited | | | | |

The individual gals are usually not trained separately, but are to a certain extent mutually determine or supplement each other within specific training. Therefore, in the following explanations we have also mainly focused on the improvement in the basic stamina which is so important for everybody.

Unlike many other types of sports sporty training with the cycle cannot only be carried out at any age, but also by those with little fitness or are even handicapped. The advantages lie in particular in the possibility to correctly dose the exercise, even for those with little fitness. Moreover, joints and muscles are not strained to an excessive extent, so that less complaints arise compared to other activities (e.g. games sports). Moreover, using the bicycle in routine everyday life can partly compensate for a lack of exercise. However, the goal should not and cannot be to substitute the sport or certain types of sports, because as shown above the effectiveness in sport is often considerably higher.

## 12. Health Training Programms

Cyclists are as different as the people who do this sport. With different prerequisites and goals, the training contents are also different. Cyclists differ in various characteristics. The following aspects have the greatest influence on the training arrangements:

- **Age**
- **Sex**
- **Type (use/ area)**
- **Intensity of use**
- **Training goal**

Categorising the cyclist allows individualisation and at the same time allows a general training recommendation to be made. The first goal of health oriented cycling should be to regularly ride a bicycle. Only through regular activity can most of the psycho-physical changes named in Chapter 1 be achieved. One example can be the change in the muscular system or a loss of weight. This does not apply as much to the psychological effects. Here very short-term effects can often be noticed. For example, a diversion from everyday life or a positive physical feeling often occurs even within a (short) trip.

### 12.1 Age

On average, women live to be 80 years old and men 74 years old (in Germany, Stat. 21). During the life of an adult, their physical fitness usually reduces. The relative maximum performance of a 30 year old man is on average 3 Watt per kg body weight. Thus, a 30 year old man who weighs 70 kg should be able to achieve maximum 210 Watt. The average power of a women is 2.5 Watt per kg weight doe to the lower muscle mass. The reduction in fitness is on the one hand due to the decrease in the muscular system, as well as due to the reduction in functionality of all the organs. The reduction in fitness is around 1% per year of a person’s life. The

fitness of a 50 year old man is thus on average around 170 Watt (for 70 kilogram weight).

Physical training cannot only considerably reduce the loss in fitness. For example, older sportspersons often have significantly better fitness and health values than 20 year younger non-sportsperson. This is however not due to the fact that the biological process of aging has been fully cancelled. However, at any age the fitness and health factors due to lifestyle can be improved, as long as they do not reach the biological limit. But in general this is rarely the case, we only have to think of the small number of highly competitive sportspersons. These often achieve a fitness, which is 100% above the average fitness.

The increase in the active aged or sporty senior citizens is not only due to the demographic development, but above all due to the change in lifestyles. Sport is no longer reserved for the young, but almost all age groups get together in sport. Thus, age is only a secondary aspect when organising training. However, not only senior citizens should have an annual medical check-up, in order to be informed about possible health risks. From the age of 35 each person should have a regular examination.

The cardiovascular system is also subject to the aging processes. Therefore, cardiac rate oriented training should ensure that the limits are appropriately defined. The maximum and relative training heart rate reduces with age. A general rule of thumb includes an allowance for age:

***Maximum age-related pulse: 220 – age in years***

The maximum heart rate (HF) of a 20 year old is normally thus 200 beats per minute. In a 70 year old 150 beats per minute. From this, a relative training heart rate should be followed. This can be simply achieved via a percentage orientation, in that the percentage value of the maximum heart rate is given. For an intensity of 70% the heart rate is thus 140 beats per minute for a 20 year old and 105 beats for the 70 year old.

For the so important general basic training, relatively untrained persons and beginners should orient themselves on the following table:

**Tab.12: Age-related training recommendations during the adaptation phase (beginners)**

| Age | Target range 50-60% of the max. HF |
|---|---|
| 20 | 100-120 |
| 25 | 97-117 |
| 30 | 95-114 |
| 35 | 92-111 |
| 40 | 90-108 |
| 45 | 87-105 |
| 50 | 85-102 |
| 55 | 82-99 |
| 60 | 80-92 |
| 65 | 77-93 |
| 70 | 75-90 |

Recommended training heart rates in different age groups in the stabilisation phase for leisure / advanced sportspersons.

**Tab.13: heart rate (HF) for different training intensities**

| Age in years | Max HF | Speed, strength | Strength, intensive stamina | Stamina |
|---|---|---|---|---|
| | **100%** | **90% -80%** | **75% - 70%** | **65% - 60%** |
| 20 | 200 | 180 – 160 | 150 – 140 | 130 - 120 |
| 30 | 190 | 171 – 152 | 143 – 133 | 125 - 114 |
| 40 | 180 | 162 – 144 | 135 – 126 | 117 - 108 |
| 50 | 170 | 153 – 136 | 128 – 119 | 111 - 102 |
| 60 | 160 | 144 – 128 | 120 – 112 | 104 - 96 |
| 70 | 150 | 135 – 120 | 113 - 105 | 98 - 90 |

In particular, endurance training at 60% of the maximum heart rate is ideally suited for achieving the health changes sought after.
Today, heart rate meters can be used not only to simply control the training but also to specifically steer it at any time.
Overall, sport is not only suited for becoming fitter and healthier, but also to remain biologically young or younger. This also counteracts the trend that older people consider themselves to be more ill than young people (Stat. 22).

## 12.2 Sex

Cycling is basically not only suited for every age, but is also equally suited for men and women. The main differences between the sexes in cycling exist above all in the following aspects.

- **Anthropometry**
- **Body shape**
- **Muscular system and strength**

In anthropometry women differ above all in a lower average height of approx. 10 cm (in Central Europe). With respect to proportions, ideal typically women differ above all through narrower shoulders and a relatively broader pelvis. The shape of the pelvis is not only relatively wider (in comparison of the same height as a man), but it is also built differently. This should be taken into consideration, especially when selecting the saddle. Seating complaints can however be found in both sexes, so that attention should be paid to an individually suitable saddle. Often differences in leg, arm and trunk lengths and their proportions are incorrectly cited. Yet this does not apply to the average size. Nevertheless it is advisable to modify the seating position for women. For example, it is purposeful to reduce the saddle-handlebar spacing. This is due above all to the lower supporting strength of the arms.

Leg strength is also lower on average, so that women often prefer an elegant pedalling style with a higher pedalling frequency. However, both sexes should seek to achieve this as this protects against over exerting the joints, tendons and muscular system. Occasional emphasis on strength riding styles is purposeful strength training above all, but not only, for very sporty cyclists in order to be able to overcome inclines or counter wind. Cycling can thus also help women to acquire better health. Women often complain of more complaints (Stat. 23). This can also be determined in increased visits to physicians compared to men (Stat. 24).

## 12.2 Type

***Mobility/ regular everyday users***

Use of a bicycle can serve different purposes. Locomotion with the cycle for mobility purposes accounts for a large percentage of these. This is more widespread among the younger population. Many young people not only travel to school or university with a bicycle, but also use it for other everyday mobility goals. Yet the average spread of the cycle as a means of mobility is very low in Europe and the USA. For example, on average the Germany only travel 200 km per year. In Holland cycling is however widespread for mobility purposes without a sort background and thus has a model function.

***Sport / leisure sportspersons***

Leisure and sport play a large role in the question of the purpose of the bicycle. Cycling is at the top of the rankings both as an active leisure occupation, and as a type of sport practiced. The trend to cycle travel is a special mix between the wish for mobility and the exercise or sport aspect. Sport competitions also emanate a special fascination, e.g. the Tour de France.

Yet there are broad spectrums of mobility and sport types. In sport the bandwidth ranges from highly competitive sportspersons through to opportunistic sportspersons. Performance and competitive sportspersons are an absolute minority in number terms. Leisure and opportunistic sportspersons represent the largest proportion. These persons do also not usually take part in competitions so that it can be determined that the uppermost thought is not the idea of performance.

## 12.4 Intensity of use

In order to achieve lasting effects on fitness and health, it is important for each target group to note several aspects. Above all regularity, i.e. multiple use of the cycle each week, is most important. This can reduce the risk of a heart attack by 50 - 70% (Stat. 24). According to training theory, a particularly efficient benefit can be achieved if the principles of exercise control are observed where possible. The adjustment of all organs and functional units react above all to regular stimuli or regular exercise. Therefore the following training schedule should help to systematically and effectively realise the intentions and goals.

## 12.5 Training goal

The individual training goal is important for the organisation of the individual exercise units. For example, if increasing the cardiac functions or weigh reduction is the main aim, then the sustained method will primarily be used.
However if a tightening and strengthening of the muscular system or even affective goals are to be achieved then the intensity of the exercise necessarily increases.

However, common to all goals is that the general basic stamina always represents the basis for all health goals and thus always represents the main part of the exercise.

## 12.6 Health planner

The implementation of exercise programmes and training recommendations should be carried out to schedule and systematically. The following examples show ideally typical courses of training over different time frames.

- Annual planning
- Monthly planning
- Weekly planning
- Planning a training unit

In classic training theory the goals and above all the competition dates are used as the basis of the planning. The attempt is made to further develop personal performance or to maintain it at a high level via training throughout the whole year and an increase over several training years. This type of seasonal planning is however only partly relevant for leisure cyclists. For health oriented cyclists it is also purposeful to implement simple planning or to follow several principles which are described in the following.

## 12.7 Annual planning

For leisure and health sport, it is purposeful to coordinate the annual planning with the seasons of the year. It is assumed that this type of cyclist rides their bike above all in the seasons with warmer and dryer weather. The main time therefore lies in the summer. In spring into summer the fitness is developed and the intensity and extent of training is increased. The physical fitness developed can still be used in autumn

for further cycling. Cycling in winter is mostly only possible to a reduced extent due to the weather and light conditions. However, a complete rest phase is not recommendable. It is easily possible to continue cycling at weekends or to train on ergometers or participate in indoor cycling course.

In addition, other types of sports are recommendable during winter. A simple programme for home training is Theraband training, which is described in the Appendix.

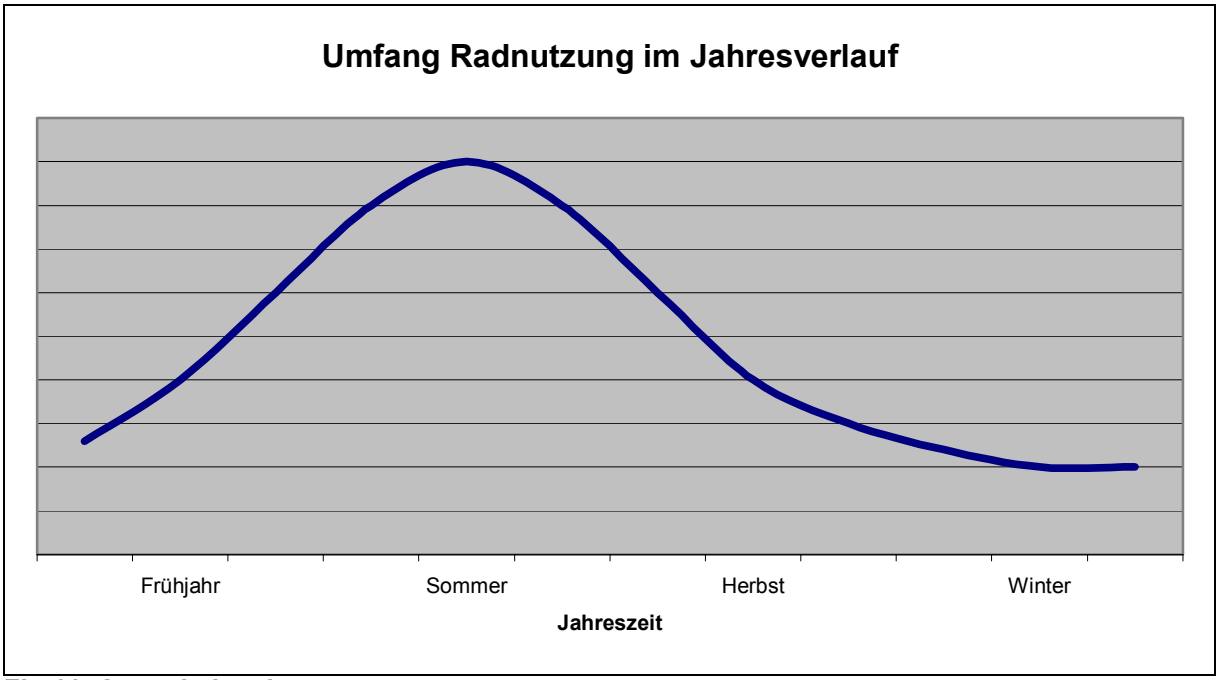



**Fig.11: Annual planning**
*Bild: Umfang Radnutzung im Jahresverlauf = Extent of cycle use during the course of the year*
*Frühjahr = Spring, Sommer = Summer, Herbst = Autumn, Winter = Winter, Jahreszeit = Season*

## 12.8 Monthly planning

Monthly planning also follows the principle of developing exercise. The exercise can be raised with an increasing number of training units or trips. This takes place in 3 weeks. In the 4th week there is a so-called recovery week, during which the person reducing the amount of cycling.

**Tab.14: Monthly planning basis – development phase/ preparation phase**

| Month / Season | Week 1 | Week 2 | Week 3 | Week 4 |
|---|---|---|---|---|
| **Spring** | 1 x 30 min | 1 x 45 min | 2 x 30 min | 1 x 45 min |
| **Summer** | 2 x 45 min | 2 x 60 min | 2 x 75 min | 1 x 60 min |
| **Autumn** | 1 x 60 min | 2 x 45 min | 2 x 60 min | 1 x 45 min |
| **Winter** | 1 x 30 min | 1 x 45 min | 1 x 60 min | 1 x 30 min |

These details provide orientation for leisure and health oriented cyclists. Ambitious cyclists can increase the training times and carry out additional training units. The following pointers can be used for this:

**Tab.15: Use intensities for cyclist types in health sport**

| Cyclist type | Training times or training units factor |
|---|---|
| Beginner | x 1 |
| Broad sportsperson/ leisure sportsperson | x 1.5 |
| Ambitious sportsperson / advanced | x 2 |

## 12.9 Weekly planning

Above all, weekly planning involves distributing the training units among the various weekdays and observing optimum spacings between exercise and recovery phases. More time is usually available at the weekend, so that the training units or excursions can and for physiological reasons should also be longer than during the week.

Moreover, exercise and rest days should be at uniform intervals. The following table illustrates this pattern.

**Tab.16: Weekly planning – development phase / preparation phase**

| Day | MO | TU | WE | TH | FR | SA | SU |
|---|---|---|---|---|---|---|---|
| **Beginners** | | | 30 min | | | | 60 min |
| **Advanced** | | | 45 min | | 45 min | | 75 min |
| **Leisure sportspeople** | | 45 min | | 60 min | | | 120 min |

## 12.10 Training unit

Each training unit (TU) should be carried out according to several principles. This applies equally for the sporty tour and for the trip to work. Basically the intensity at the start and end of each training unit is lower than in the middle. The so-called warm-up serves to prevent injuries and thus to maintain health. A cool down accelerates the regeneration processes and can prevent complaints, e.g. stiff muscles. The basic speed should not be exceeded either during the warm up or during the cool down. The basic speed is the endurance speed (see above), which around 60 – 70%. During the middle section the intensity can lie above the basic speed for a certain length of time. This can be achieved using various training methods, such as the sustained method or the interval method. The intensity can then lie within the range of strength and speed (see above) for several minutes, or in case of good fitness for a longer period. In case of physical complaints however the intensity should be reduced.


FS = trip allowance, Intervals; DM = sustained method; HFmax = maximum heart rate

**Fig. 12: Intensity during a training unit – trip allowance and sustained method**

*Zeit = time, Intensity = intensity*

The training guidelines named above can be more easily implemented for sport training. However the principles can also be applied for regular everyday cycling.

## 12.11 Cycle training and mobility

Cycle training for the mobility type cannot or can only be poorly planned due to the usually considerably shorter routes and irregular use. Training in a sporting sense can therefore often not be implemented. Nevertheless, effects on fitness and health can still be determined as a result of regular everyday cycling. These are greater the longer the use period and the higher the intensity. On average the routes travelled with the cycle are only a few kilometres long so that travel times of 10 to 20 minutes per route result. This exercise is only sufficient to achieve an average fitness at beginners level. However, the calorie turnover can accumulate during frequent use (e.g. each day 15 minutes to work and back) so that during the week an additional

2000-3000 kcal are used up by exercise. This has positive effects, above all on cardiac health. This degree of exercise can also be the entry to sporting activity for beginners or people with a small extent of activity and exercise. However, the following aspects should be observed to achieve greater health effects.

- Use the cycle more frequently (irrespective of the purpose)
- Length the cycling routes (e.g. on the way home)
- Additional longer routes (e.g. at the weekend in a sporting context)
- Increase the cycling speeds or intensities (light perspiration)
- Introduce sporting or relaxing elements (e.g. alternative ways via low traffic and attractive landscape routes)

The following recommendations apply for different types of everyday cyclists. Attention should be paid to ensuring that the weekend tour has a certain length and intensity. The lengths for the weekend tours given below are on the one hand only to be considered as being examples and on the other can be stepped up according to the principles given above with increasing fitness or training conditions. The calorie consumption given is the sum of all the exercise over a week of cycling with the given extents. The values can fluctuate depending on body weight and intensity. However in order to gain an optimum effect for health, the aim should be to achieve a consumption of approx. 1600 – 2000 kcal from the everyday use and the leisure activities.

**Tab.17: Recommended frequency for routine everyday cyclists**

| Training phase | Type | Working week | Weekend | Total calorie consumption at stamina intensity ² | Exercise intensity % max. HF |
|---|---|---|---|---|---|
| Adaptation phase | Beginner | 5 x 20 min | | 900 kcal | 50 – 65% |
| Development phase | Ambitious | 5 x 20 min | 2 x 45 min | 1800 kcal | 60 – 85% |
| Stabilisation phase | Intensive | 5 x 20 min | 1 x 90 min | 2200 kcal | 60 –95% |
| ² Initial value 600 - 800 kcal / h. moderate cycling | | | | | |

If the adaptation phase has been completed and a certain basic stamina has been created, it is advisable to increase the exercise intensity, i.e. the cycling sped within the scope of the shorter everyday exercise, even regularly on shorter route sections of five to ten minutes.

Everyday cyclists at any rate profit from the activity in normal life and therefore no longer have to invest as much additional time and effort for their health. They must only supplement their training through longer units, in order to achieve the “all-round protection” for their health guaranteed by the exercise activity.

## 12.12 Exercise duration and training effects

The effects of cycling on health and specially the psycho-physical functions and capabilities are primarily dependent on the length of time it takes effect (= exercise duration) and from the level of exercise per time unit (= exercise intensity). For most parameters the exercise duration is a decisive variable, so that we have compiled a summary of the effective mechanisms depending on the training time. Only the main effects for health and well-being are listed, even though parallel effects of the activity always result and reciprocal change influences also can be determined.

| Cycling (exercise period) | | Main effects |
|---|---|---|
| 10 min | ➡ | Muscular system, circulation, joints |
| 20 min | ➡ | Immune system |
| 30 min | ➡ | Cardiac functions |
| 40 min | ➡ | Stamina/endurance capability |
| 50 min | ➡ | Metabolism (fat metabolism) |
| 60 min | ➡ | Body weight, attractiveness |
| > 60 min | ➡ | Anti-stress, well-being |

# Appendix:

## A. Additional Training with the Theraband

## B. Statistics and Facts

## C. Literature List

## A. Additional Training with the Theraband

The Theraband is the ideal exercise device for additional training in addition to cycling. During cycling various organs and muscles are used, the main demands are made on the cardio vascular system and the leg musculature. The Theraband can be used as an ideal training device to counteract any faulty exercise or strain due to an underdeveloped support apparatus or tensions. It enables balanced muscle training without faulty exercise or strains being able to occur. This sports device has several important advantages compared to other sports equipment. Due to the very low price and its small size it is ideal for everyday use. Especially the ability to use it anywhere is a decisive advantage compared to other sports equipment, and not other apparatus or rooms are necessary. The relatively low training intensity also protects the unpractised user against overstressing their muscles, etc. Theraband training nevertheless suffices as training for muscles otherwise not used (compensatory training). Use the Theraband several times a week (2-4 times) – you will only need 10 minutes each time.

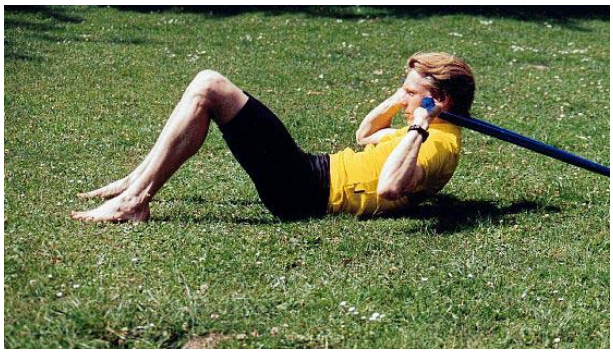
The following exercises show training for various groups of muscles e.g. back, shoulder girdle and abdomen muscles. Each of the exercises is graphically illustrated and are then precisely explained by a brief text.

### Exercises

All Theraband exercises are carried out slowly and in a controlled manner. Breath out against the resistance. 15-25 repetitions are optimal. Repeat exercises 1- 3 times. Between the sets of exercises breath in deeply and relax the muscles.

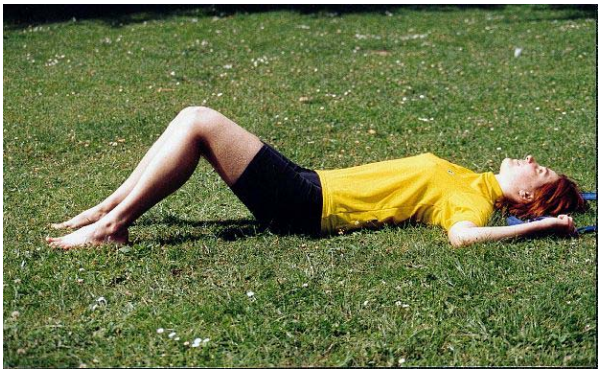
**Exercise 1: Straight abdominal muscles (rectus abdominus)**

*Starting position:*
Fasten the band and grip the ends

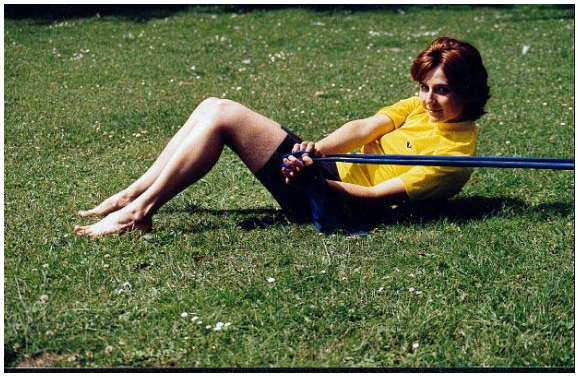


*Final position:*
Slowly roll up, the lumbar spine (LWS) remains on the ground, head position in extension of the spine (WS)

**Exercise 2: Oblique abdominal muscles**

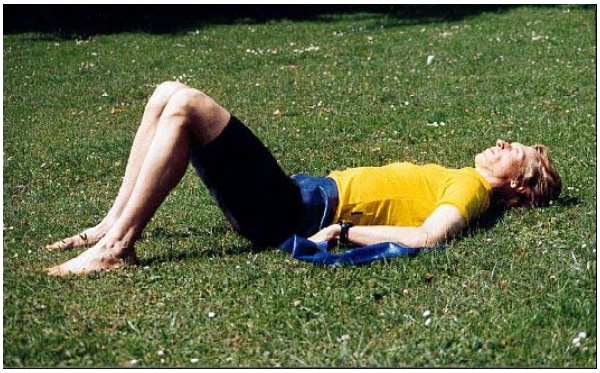


*Starting position:*
Fasten the band and grip the ends

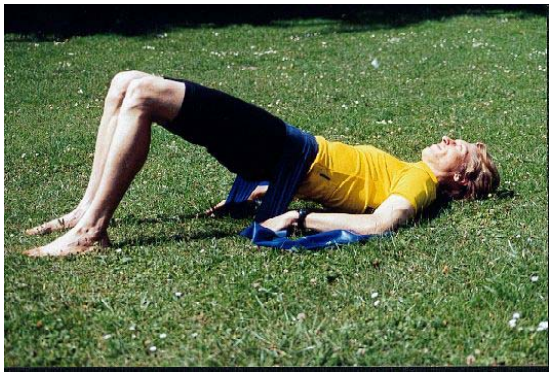


*Final position:*
Slowly roll up diagonally (to the side), lumbar spine (LWS) remains on the ground, roll up the head at the same time, also to the side, pull the arms to the outside of the leg

**Exercise 3: Back – shoulder muscles**



*Starting position:*
Place the band over the hips, hold your



*Final position:*
Slowly lift your bottom until the knee and

hands on the ground, feet apart at hip width, knees at right angles

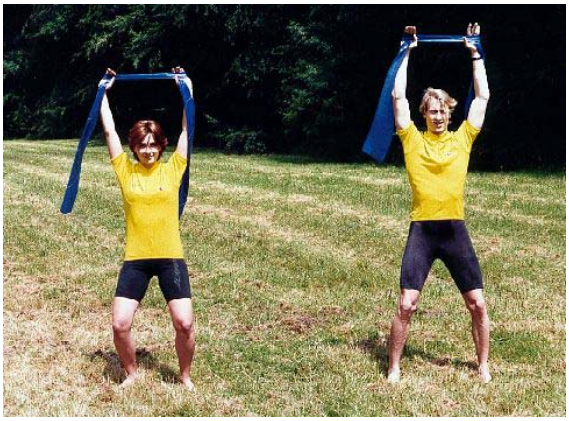
bottom form a line, tighten the muscles in the bottom, back and abdomen

**Exercise 4: Back – rowing**

*Starting position:*
Stretch the band across the feet, grip the ends – arms are extended, keep back straight

*Final position:*
Keeping the back straight, pull the hands up to the waist, breathing out at the same time

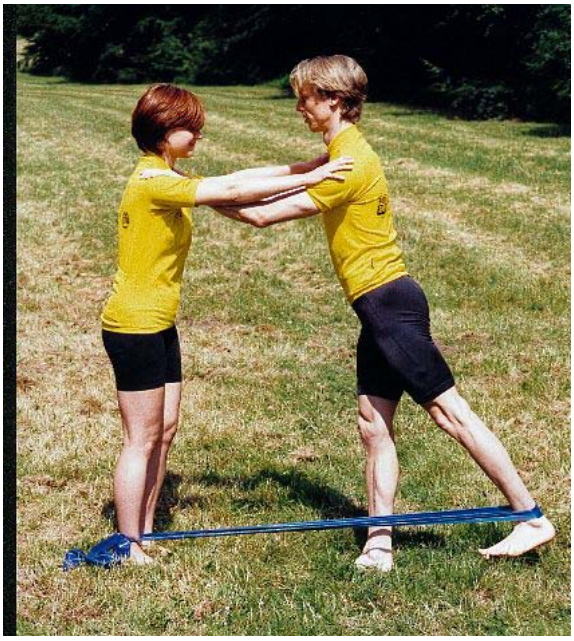
**Exercise 5: Upper back – side pulls**



*Starting position:*
Feet apart shoulder wide, knee slightly bent, back straight – no hollow in base of spine, arms stretch upwards, hold band tight

*Final position:*
Pull band wide apart, hands down to shoulder height, band behind the shoulders, back straight

**Exercise 6: Bottom – back – backs of legs**



*Starting position:*
Fasten the band around a leg of each person, legs stable hip width apart, hold on fast to partner,

*Final position:*
Slowly swing leg back 50 cm while keeping back straight (no hollow in base of spine), 15-25 repetitions, then the partner, change leg

**Exercise 7: Chest and shoulders – butterfly**

*Starting position:*
Stand straight in stepping position, arms in U-shape, hands at head level, hold firmly onto band

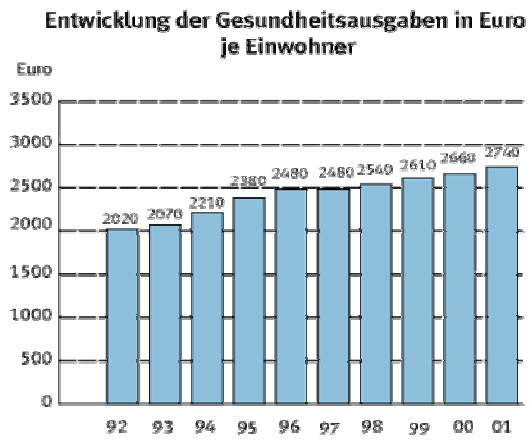
*Final position:*
Guide arms forward in semi-circular shape, until the lower arms are together, slowly return to starting position

**Exercise 8: Shoulders, back arm swing**

*Starting position:*
Fasten band, grip ends, stand up straight in stepping position, arms stretched forward, pull shoulders downwards

*Final position:*
Pull band to the back, press the shoulders down, chest out, tighten stomach, at the same time breathing out, slowly reverse movement

## B. Statistics and Facts

| No. | Statistics/ Facts | Further information | Source No. |
|---|---|---|---|
| 1 | Wellness is an active process, not only the absence of illness | Influenceable risk factors for heart diseases:<br>• Lack of exercise<br>• Overweight<br>• Smoking<br>• High blood pressure<br>• Diabetes<br>• Hypercholesterol | 6 |
| 2 | 22.7% of Germans cycle sometimes | 17.5% of the Germans say that they sometimes drive a mountain bike | |
| 3 | Motives for doing sport change | Fun: ´95, 70%; ´02, 30%<br>Health: ´95, 15%; ´02, 40%<br>Fitness: ´95, 15%, ´02 30% | 8 |
| 4 | Around 40% of German women never do sport. | 34% of men never do sport | 11 |
| 5 | Health expenditure continuously increasing<br>- graph of development of health expenditure in Euro per inhabitant |  | 5 |
| 6 | In 1998 in Austria health savings due to sport activity were 264 mln. €. | Savings due to reduced days off work due to sickness and lower treatment costs | 1 |

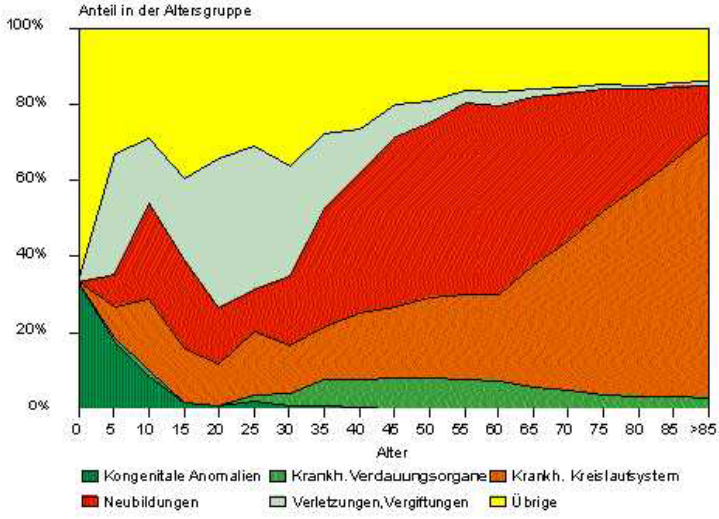
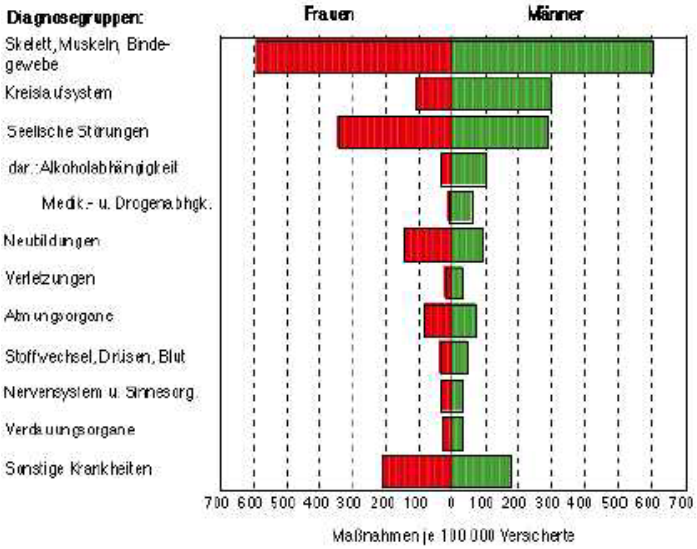
<table>
<tr><td>7</td><td>Causes of death change with age; Cancer is the main cause of death in women between 40 and 65<br>(Anteil in der Altersgruppe = Proportion in the age group; Fig. 3a: Main causes of death in women, profile according to age, Congenital anomalies. Diseased digestive organs, diseased circulatory system, new growth, injuries, poisoning, other</td><td> 

Abbildung 3a: Haupttodesursachen bei Frauen, Profil nach Alter, Nordrhein-Westfalen, 1997</td><td>2</td></tr>
<tr><td>8</td><td>Social class is a factor for obesity</td><td>Distribution of obesity in different social classes:<br>Lower class: 22.3%m / 31.4%W<br>Middle class: 18.9%m / 20.3%w<br>Upper class: 16.2%m / 9.9%w</td><td>4</td></tr>
<tr><td>9</td><td>Mortality risk increases with higher BMI.</td><td>Mortality index dependent on BMI:<br>(in percent)
<table>
<tr><td>BMI</td><td>25-32</td><td>32-36</td><td>36-40</td><td>>40</td></tr>
<tr><td>Men</td><td>1</td><td>1.2</td><td>1.27</td><td>2.31</td></tr>
<tr><td>Women</td><td>1.26</td><td>1.31</td><td>1.92</td><td>3.05</td></tr>
</table></td><td>4</td></tr>
<tr><td>10</td><td>Most therapies are carried out for skeletal diseases, cardiovascular and psychological disorders<br>Fig. 6: Medical rehabilitation measures: Rehabilitation according to diagnosis groups and sex Measures per 100000 persons with health insurance</td><td> 

ildung 6: Medizinische Rehabilitationsmaßnahmen: Rehabilitanden nach Diagnosegruppen und Geschlecht, Nordrhein-Westfalen, 1997</td><td>2</td></tr>
</table>

**11** — The most frequent causes of premature death involve the cardiovascular system and cancer — 2

| Todesursache (Hauptgruppe der ICD-9) | Sterblichkeit je 100 000 Einw. | Verhältnis Frauen : Männer |
|---|---|---|
| Neubildungen (bös- u. gutartige) insges. | 91,7 | 1 : 1,4 |
| Krankheiten des Kreislaufsystems | 75,8 | 1 : 2,6 |
| Verletzungen und Vergiftungen | 20,9 | 1 : 3,1 |
| Symptome u. schlecht bezeichnete Affektionen | 20,0 | 1 : 2,3 |
| Krankheiten der Verdauungsorgane | 17,0 | 1 : 1,9 |
| **alle Todesursachen** | **265,1** | **1 : 2,0** |

**12** — In the EU cardiovascular diseases are the cause of 40% of deaths — 7

Standardised mortality rate (per 100 000 inhabitants) sorted by the most frequent causes of death in the EU, 1996

| | All causes of death | | Cancer | | Disease of the cardiovascular system | |
|---|---|---|---|---|---|---|
| | men | women | men | women | men | women |
| EU-15 | 938 | 552 | 268 | 149 | 358 | 227 |
| B* | 1 041 | 588 | 307 | 155 | 351 | 221 |
| DK | 1 049 | 683 | 275 | 207 | 374 | 221 |
| D | 1 000 | 591 | 268 | 160 | 433 | 274 |
| EL | 844 | 566 | 220 | 118 | 384 | 296 |
| E | 901 | 498 | 266 | 120 | 290 | 201 |
| F | 911 | 474 | 300 | 134 | 255 | 146 |
| IRL | 1 065 | 666 | 257 | 174 | 465 | 279 |
| I | 851 | 503 | 271 | 143 | 324 | 214 |
| L | 1 011 | 551 | 282 | 143 | 406 | 234 |
| NL** | 954 | 565 | 287 | 163 | 358 | 205 |
| A | 963 | 580 | 252 | 152 | 463 | 307 |
| P | 1 174 | 687 | 246 | 129 | 428 | 307 |
| FIN | 1 037 | 566 | 231 | 128 | 444 | 247 |
| S | 810 | 511 | 196 | 145 | 380 | 219 |
| UK | 949 | 610 | 256 | 174 | 398 | 237 |

Reference: Eurostat; * Figures 1993; **Figures 1995

**13** — The most frequent causes for hospital treatment involve the cardiovascular system and new growth — 2

Fig. 5: Hospital cases by ICD main diagnosis groups and sex

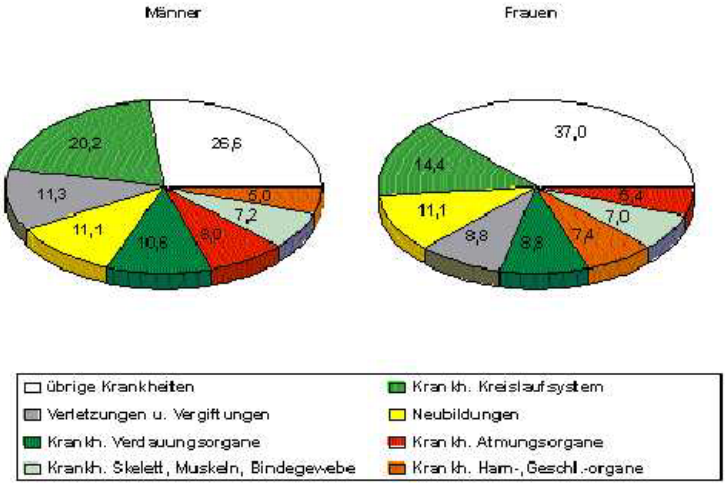



Abbildung 5: Krankenhausfälle nach ICD-Hauptdiagnosegruppen und Geschlecht, Nordrhein-Westfalen, 1997

<table>
<tr><td>13</td><td>29% of women and 26% of men have very high cholesterol levels over 250 mg/dl.<br>Table 11: Proportion of men and women with increased total cholesterol</td><td>

| Altersgruppen in Jahren | Erhöhtes Gesamtcholesterin in % der Befragten | |
|---|---|---|
| | Frauen | Männer |
| 25 - 29 | 11,5 | 15,5 |
| 30 - 39 | 14,7 | 24,6 |
| 40 - 49 | 35,7 | 40,6 |
| 50 - 59 | 63,1 | 47,0 |
| 60 - 69 | 61,6 | 47,6 |
| 25 - 69 | **39,4** | **35,8** |

Tabelle 11: Anteil von Frauen und Männern mit erhöhtem Gesamtcholesterin (>= 250 mg/dl), Nordrhein-Westfalen, 1991

</td><td>2</td></tr>
<tr><td>14</td><td>Back pains are widespread, especially in the over 40’s<br>Table 5: Details of back pains (slipped discs and/or spinal complains)</td><td>

| Alters-gruppen in Jahren | Rückenbeschwerden in % | | | | | |
|---|---|---|---|---|---|---|
| | 1984 | | 1988 | | 1991 | |
| | Frauen | Männer | Frauen | Männer | Frauen | Männer |
| 25 - 29 | 7,0 | 18,6 | 21,2 | 11,4 | 12,0 | 13,6 |
| 30 - 39 | 8,7 | 12,5 | 11,0 | 15,2 | 14,3 | 15,3 |
| 40 - 49 | 25,2 | 28,4 | 23,4 | 29,7 | 26,6 | 25,3 |
| 50 - 59 | 33,4 | 32,2 | 23,1 | 35,0 | 27,9 | 34,7 |
| 60 - 69 | 42,0 | 41,4 | 35,9 | 30,5 | 40,9 | 31,3 |
| 25 - 69 | **24,5** | **26,1** | **22,9** | **25,1** | **25,3** | **24,4** |

Tabelle 5: Angaben zu Rückenbeschwerden (Bandscheibenschaden und/oder Wirbelsäulenbeschwerden) in Nordrhein-Westfalen, 1984, 1988, 1991

</td><td>2</td></tr>
<tr><td>15</td><td>16% of women and 20% of men have a high blood pressure, a similar number reach a critical limiting value<br>Figure 9: Proportion of men and women with increased blood pressure</td><td>

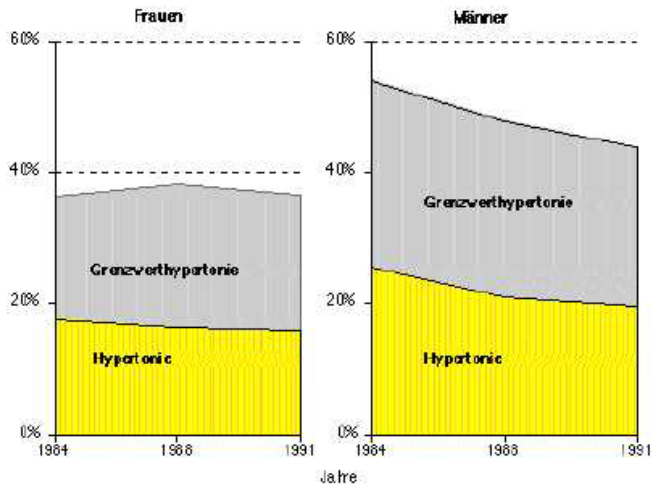



Abbildung 9: Anteil von Frauen und Männern mit erhöhtem Blutdruck, Nordrhein-Westfalen, 1984 - 1991

</td><td>2</td></tr>
<tr><td>16</td><td>Most people believe they can actively influence their health (>70%).<br>Table 8: Ability to influence own health condition (% of men and women asked)</td><td>

| Jahr | Beeinflussbarkeit des Gesundheitszustandes in % | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Frauen | | | | Männer | | | |
| | sehr viel | viel | einiges | wenig/ nicht | sehr viel | viel | einiges | wenig/ nicht |
| 1984 | 23,3 | 37,7 | 35,3 | 3,7 | 28,5 | 38,5 | 31,0 | 2,0 |
| 1988 | 37,8 | 33,4 | 26,4 | 2,4 | 30,3 | 41,6 | 24,9 | 3,2 |
| 1991 | 33,6 | 35,6 | 27,8 | 3,0 | 33,6 | 40,0 | 24,0 | 2,4 |

Tabelle 8: Beeinflussbarkeit des eigenen Gesundheitszustandes (% der befragten Frauen und Männer), Nordrhein-Westfalen, 1984 - 1991

</td><td>2</td></tr>
</table>

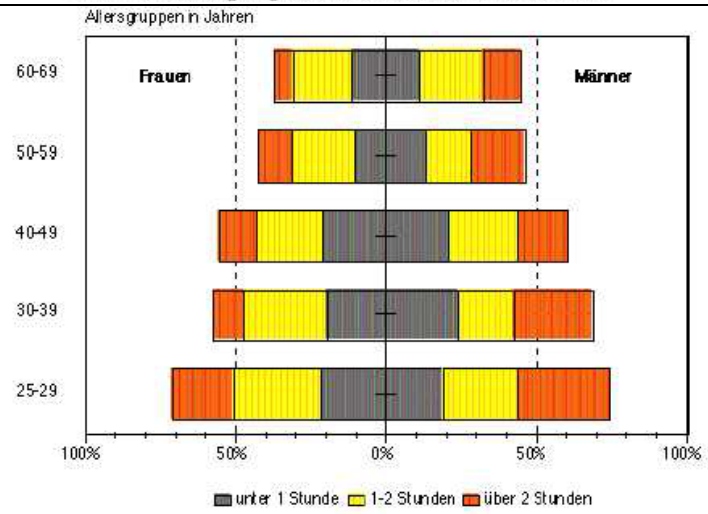
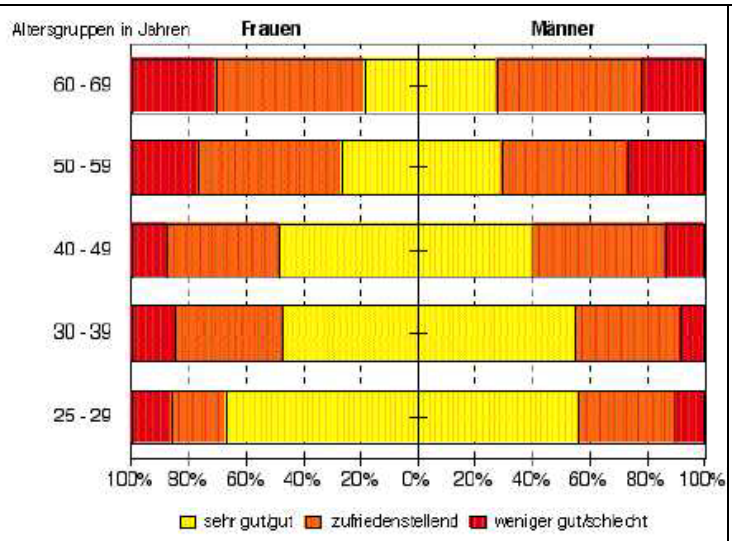
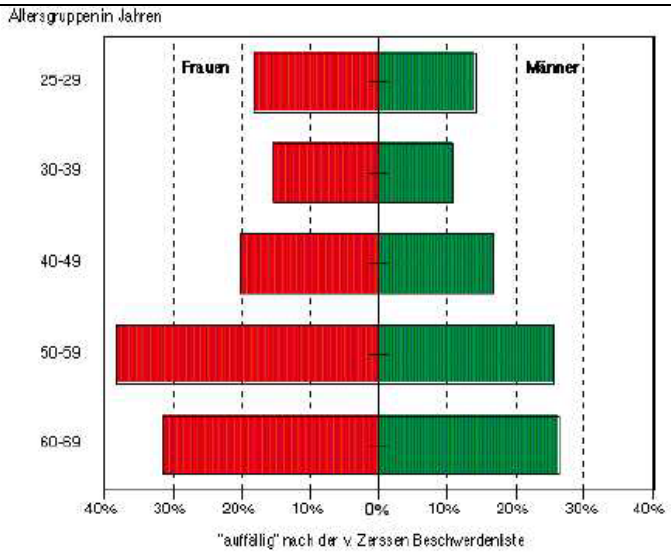
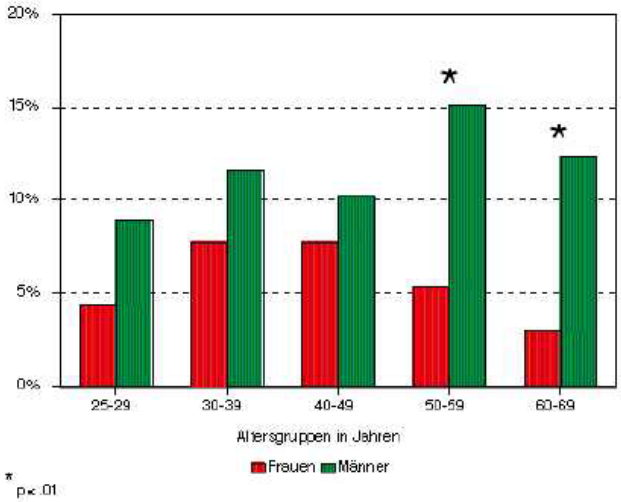
<table>
<tr><td>17</td><td>Diet has become more healthy<br>Table 10: Changes in consumption in persons asked who have changed their diet within the past 3 years</td><td>
<table>
<tr><th rowspan="3">Konsum von:</th><th colspan="4">% der Befragten</th></tr>
<tr><th colspan="2">Frauen</th><th colspan="2">Männer</th></tr>
<tr><th>weniger</th><th>mehr</th><th>weniger</th><th>mehr</th></tr>
<tr><td>Butter</td><td>72,8</td><td>6,2</td><td>67,6</td><td>4,5</td></tr>
<tr><td>Margarine</td><td>33,5</td><td>28,6</td><td>27,2</td><td>34,8</td></tr>
<tr><td>Fleisch, Wurst</td><td>62,0</td><td>2,8</td><td>50,0</td><td>6,0</td></tr>
<tr><td>Obst, Gemüse</td><td>2,0</td><td>70,1</td><td>4,1</td><td>64,7</td></tr>
<tr><td>Vollkornprodukte</td><td>7,2</td><td>61,2</td><td>7,9</td><td>59,5</td></tr>
<tr><td>Kochsalz</td><td>59,5</td><td>1,6</td><td>53,3</td><td>1,6</td></tr>
<tr><td>Nahrungsmenge ingesamt</td><td>55,2</td><td>4,2</td><td>46,6</td><td>6,9</td></tr>
</table>
Tabelle 10: Konsumänderungen bei Befragten, die innerhalb der vorausgegangenen 3 Jahre ihre Ernährung umgestellt haben, Nordrhein-Westfalen, 1991
</td><td>2</td></tr>
<tr><td>18</td><td>25% of women and 41% of men do more than one hour's sport per week.<br>Figure 8: Proportion of persons doing sport by duration of sport activity per week</td><td>


Abbildung 8: Anteil der Sporttreibenden nach Dauer der sportlichen Betätigung pro Woche, Nordrhein-Westfalen, 1991
</td><td>2</td></tr>
<tr><td>19</td><td>More than 50% of the Germans want to do more sport</td><td>This wish will considerably change the sport market in the coming years</td><td>10</td></tr>
<tr><td>20</td><td>Most people (> 80%) feel healthy<br>Table 7: Own assessment of health condition (% of men & women asked)</td><td>
<table>
<tr><th rowspan="3">Jahr</th><th colspan="6">Eigenbewertung des Gesundheitszustandes in %</th></tr>
<tr><th colspan="3">Frauen</th><th colspan="3">Männer</th></tr>
<tr><th>sehr gut/gut</th><th>zufrieden-stellend</th><th>weniger gut/schlecht</th><th>sehr gut/gut</th><th>zufrieden-stellend</th><th>weniger gut/schlecht</th></tr>
<tr><td>1984</td><td>33,0</td><td>43,4</td><td>23,6</td><td>38,3</td><td>44,8</td><td>16,9</td></tr>
<tr><td>1988</td><td>40,2</td><td>44,1</td><td>15,7</td><td>41,2</td><td>44,0</td><td>14,8</td></tr>
<tr><td>1991</td><td>39,8</td><td>41,3</td><td>18,9</td><td>41,3</td><td>42,3</td><td>16,4</td></tr>
</table>
Tabelle 7: Eigenbewertung des Gesundheitszustandes (% der befragten Frauen und Männer), Nordrhein-Westfalen, 1984 - 1991
</td><td>2</td></tr>
<tr><td>21</td><td>Life expectancy is increasing</td><td>Men 74 years, women 80 years; tendency rising</td><td>2</td></tr>
</table>

| | | | |
|---|---|---|---|
| 22 | Younger people feel more healthy<br>Age group in years |  | 2 |
| 23 | Men feel more healthy than women |  | 2 |
| 24 | Active (sporty) people have a reduced heart attack risk (minus 50-70%). | Comparison between 1 x sport / month with 1-2x sport/ week (PAR value). | 1 |
| 24 | Women (and especially older women) more frequently visit a doctor than men |  | 2 |

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