

# Increased Premature Mortality of Competitive Powerlifters Suspected to Have Used Anabolic Agents

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Misuse of supraphysiological doses of anabolic steroids is claimed to have serious side effects. The aim of the study was to determine the mortality, and the cause of premature deaths among a group of subjects who are strongly suspected to have used anabolic steroids for a non-medical purpose over several years. The mortality of 62 male powerlifters placed 1st–5th in weight series 82.5–125 kg in Finnish championships during 1977–1982 was compared with the mortality of population controls. The mortality during the 12-year follow-up was 12.9% for the powerlifters compared to 3.1% in the control population. By 1993 eight of 62 powerlifters and 34 of 1094 population controls had died, thus the risk of death among the powerlifters was 4.6 times higher (95% CI 2.04–10.45;  $p = 0.0002$ ). The causes of premature death among the powerlifters were suicide (3), acute myocardial infarction (3), hepatic coma (1) and non-Hodgkin's lymphoma (1). These findings add to the growing amount of evidence of an association between anabolic steroid abuse and premature death, and support the view that measures to decrease AAS misuse among both competitive and amateur athletes are justified.

**Key words:** anabolic steroids, doping, increased mortality, cardiovascular diseases, suicides.

## Introduction

Physical activity is an important factor in the risk of developing coronary heart disease (CHD) [12] and other disorders, with high physical activity being associated with lower mortality [14, 8]. The prolonged life expectancy of elite former endurance athletes is largely explained by reduced mortality

from cardiovascular disease [15]. Elite athletes from earlier in the 20th century had a decreased risk of diabetes mellitus, hypertension and ischemic heart diseases in later life [7]. In addition, former power sports athletes had at least as high life expectancy and as low prevalence of chronic diseases as the control population [15, 7].

Abuse of anabolic androgenic steroids (AAS) became fairly commonplace in the 1970s and 1980s, particularly in the power sports. The uncontrolled use of anabolic steroids is no longer localised to competitive athletes as they are nowadays being used widely by amateur power athletes, and also by non-athletic groups [5, 6]. The abuse of AAS has thus become an important public health issue. Supraphysiological doses of AAS stimulate protein synthesis and increase muscle mass and power, especially when combined with weight training [3]. However, the abuse of supraphysiological doses of AAS has many serious side effects [19] which may increase athletes' risk of cardiovascular disease and sudden cardiac death. AAS-induced adverse cardiovascular effects include altered serum lipoprotein profile, cardiac hypertrophy and possible direct toxic effects on cardiac muscle and blood coagulation [10]. The mental side effects of AAS are individual and context-dependent, but association between AAS use and increased aggressiveness, impulsiveness and depression has been demonstrated [2]. Although most of the shorter-term side effects of the anabolic steroids are well known by now, the possibility of irreversible long term adverse effects remain.

The aim of this study was to examine the mortality and the cause of possible premature deaths among a group of powerlifters strongly suspected to have used anabolic steroids and possibly other performance enhancing substances for non-medical purposes over a considerable length of time. Finnish male powerlifters who competed at top levels during 1977–1982 were selected as the study group. The use of anabolic steroids among top level powerlifters during these years is considered to have been widespread as powerlifting did not come within doping controls until 1984. The study provides important information on the possible long term adverse effects of anabolic steroid abuse.

## Material and Methods

Male powerlifters placed 1st–5th in weight series 82.5–125 kg in Finnish championships during 1977–1982 were chosen as study subjects. The only two subjects who were unable to be traced were excluded from the study group, leaving a final number of 62 out of 64 powerlifters. The subjects were born between 1931–1958; the mean age during their active powerlifting career was 35.1 years ( $\pm 6.9$  years), and the mean body weight 107.4 kg ( $\pm 13.3$  kg).

The control group was selected from subjects of the Finnish FINRISK survey, which was part of the WHO MONICA study done in 1982 [17]. The population survey assessed the levels of coronary risk factors in two areas of east and one area of southwest Finland. The random population samples in the 25–64-year age group were taken from the Central Population Register, though only men were used in the present analyses. Causes of deaths during 1982–1993 were linked to the survey cohort from the Cause of Death Bureau of the Central Population Register. The controls were selected from the FINRISK-82 study material by their age so that the relative proportion of each five-year age group in both the study group and the population control group was similar. The number of control subjects totalled 1094, of whom 34 had died during the follow-up period.

The personal and vital data (11-character personal identification code, date of birth, place of residence, date and place of death) of the powerlifters were obtained from the Population Data Service of the Central Population Registry of Finland with permission from the appropriate authority. Copies of death certificates for the deceased study subjects and controls were obtained using the Cause-of-Death files at Statistics Finland with their permission. The cause of death on the certificate was recorded using the International Classification of Diseases (ICD-8). A logistic regression model was used to calculate the odd ratios and their confidence intervals.

## Results

The mortality among the powerlifters during the 12-year follow-up was 12.9%; by 1993 eight of the 62 study subjects had died. The mean age of death was 43 years (range 36–53 years). Three of these eight deaths were suicides, while three others were due to coronary heart disease accompanied by hypertrophic and/or dilated cardiomyopathy, dyslipidaemia, hypertension or diabetes mellitus. One of the powerlifters died of hepatic coma caused by cirrhosis of the liver and one of non-Hodgkin's lymphoma.

During the same follow-up period, the mortality of the population control group was 3.1%; 34 had died. Cardiovascular deaths covered 50% of the deaths of the population control group. Eight of the 34 deaths (24%) were accidental. Both cancer and suicides covered 12% of the deaths each. None of the neoplasms were of haematological origin. In addition, there were single deaths of pulmonary tuberculosis, viral disease and chronic liver or kidney disease.

The powerlifters experienced a 4.6-fold higher risk of death than the population controls (95% CI 2.04–10.45;  $p = 0.0002$ ).

## Discussion

These data suggest that the use of anabolic steroids is causing premature deaths. The causes of death were mainly as expected from the abuse of anabolic steroids. Acute cardiovascular side effects [13] as well as liver toxic effects [16] are well described in the literature, and although the concentration between suicidal behaviour and AAS abuse is more complicated, it is probable [11,4]. There is no known association between non-Hodgkin's lymphoma and AAS use, but a suspected link between growth hormone use and haematological malignancies has been documented [9].

The prevalence of cancer and cardiovascular deaths in both groups was approximately the same. Suicides were relatively more common among the powerlifters than the population control group. Accidental deaths were common in the population control group. Among the powerlifters all deaths were due either to sickness or suicide.

Finnish powerlifters in the late 1970s and early 1980s were probably the group most likely to have used anabolic steroids and other performance enhancing substances such as growth hormones and stimulants. At that time, a common pattern and practise of anabolic steroid use was to use both oral and injectable steroids, and more than one compound at the same time. The doses used exceeded many times the recommended maximal dosages in medical use [1]. However, there are no means to reliably record any AAS abuse at an individual level in an epidemiologic study. The limitations of our study also include the possibility that powerlifters may be a selected group in terms of some other characteristics, too.

Power training in itself does not seem to increase mortality. Sarna et al. [8] compared former elite weightlifters earlier in the 20th century with normal healthy referents. The male athletes had represented Finland at least once at Olympic games, World or European championships or other international weightlifting competitions during 1920–1965. The use of doping, particularly AAS, in sports before the 1960s can be considered rare [18]. The total mortality of the weightlifters and referents was the same, the mean life expectancies being 70.0 years and 69.9 years, respectively.

The findings of this study and existing evidence of the adverse effects of AAS support the strict doping controls for anabolic steroids and other doping agents. Both research and education on the immediate and long term side effects of AAS should be intensified.

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