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# Associations between physical activity and semen quality in young healthy men

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**Objective:** To evaluate whether the level of everyday physical activity is associated with semen quality in young men.
**Design:** Cross-sectional study.
**Setting:** Universities, clubs, and societies.
**Patient(s):** Young healthy men (aged 18–35 years) with unknown fertility (n = 177).
**Interventions(s):** Collection of data on medical history, lifestyle factors (physical activity, nutrition, addictions), and environmental threats (exposure of gonads to cellular phones, laptops). Collection of semen samples.
**Main Outcome Measure(s):** Semen parameters.
**Result(s):** Men who were physically more active (3rd and 4th quartiles) had a higher percentage of immotile sperm than less active subjects (1st and 2nd quartiles). The mean (95% confidence interval) percentages were, respectively: 53% (38%–69%) and 51% (41%–61%) versus 38% (28%–49%) and 39% (29%–48%). Other semen parameters were unrelated to physical effort.
**Conclusion(s):** Physical activity might be associated with an altered percentage of immotile sperm in young, lean, educated men who have not fathered children. (Fertil Steril® 2016;■:■–■. ©2016 by American Society for Reproductive Medicine.)
**Key Words:** Semen quality parameters, semen analysis, physical activity



Physical activity is an established means to maintain fitness and health. Physicians commonly recommend "more exercise" as an integral part of therapy in a range of health conditions. Multiple benefits of exercise have been shown for individuals of different ages, genders, and body statuses (1).

Although there has been expanding knowledge on the cardiovascular, oncologic, and psychologic effects of an active lifestyle, the same progress has not occurred in understanding the association between physical effort and reproduction (2, 3). In consideration of a worldwide problem of male factor infertility, there are reasons to ask about the links between exercise and male reproductive health (4).

The available information on the relationship between physical activity and semen quality is often ambiguous. Some authors have found associations between physical activity and semen parameters (5, 6) whereas others have not (7, 8). It may be supposed that professional sport poses specific threats in this regard. Conclusions are hindered because of other lifestyle variables (diet, addictions), the environment (pollution, toxins), and chronic conditions (medications). Certain types of training (cycling), the intensity of exercise (intense vs. moderate), and type of underwear (tight vs. loose) specifically interfere with the results. Working with laptops or carrying cellular phones might also have some impact on the male gonads.

The fact that not only professional but also recreational athletes widely use hormonal doping makes investigations in this field even more difficult. A range of commonly used, albeit illegal, substances interfere with the hypothalamus-pituitary-gonadal axis (e.g., anabolic-androgenic steroids, gonadotropins) (9, 10).

It is important to consider geographic patterns or gradients in sperm quality (11, 12). Moreover, when comparing past and present andrologic data, it is necessary to consider a secular trend in sperm counts (13, 14) and changes in semen analysis techniques over time (15, 16).

Our aim was to evaluate whether the level of everyday physical activity is associated with semen parameters

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in young healthy men. For many reasons (personal, cultural, religious), this population is rarely screened. We wanted to omit the bias of recruitment of infertile or subfertile subjects whose semen profiles could be altered a priori. Unlike other protocols, we did not offer any financial incentives to the participants. Knowledge on the possible effects of exercise on semen quality should be of value to anyone interested in human reproduction.

## MATERIALS AND METHODS

The aim of this project, entitled "Andrologic Status of Young Men in Lower Silesia" (AndroLS), was to evaluate the associations between a range of lifestyle factors (physical activity, diet, addictions) and the seminologic/hormonal profiles of young men with unkown fecundity.

This project was approved by the local Bioethics Committee (no. 36/2.12.2013). We obtained written informed consents from all subjects before their participation. The procedures were conducted in compliance with the Declaration of Helsinki for human subjects and the European Communities Council Directive of 24 November 1986 (86/609/EEC).

We addressed our invitations to young (aged 18–35 years) healthy men who were inhabitants of Lower Silesia, Poland. The region of Lower Silesia has a population of nearly 3 million people and belongs to one of the most industrialized parts of the country.

We contacted potential participants through personal communication and fliers at major regional universities, invitations to societies/clubs, and messages sent via social media. We directly addressed ~5,000 men. The eligibility criteria were: an absence of any known andrologic pathology (past and present), such as hypogonadotropic or hypergonadotropic hypogonadism; an absence of urogenital surgery; an absence of chronic conditions; and an absence of substances that might interfere with laboratory evaluations.

The initial 500 enrollees were asked to complete questionnaires covering their medical history, nutritional habits (7-day recall diary), and physical activity (IPAQ; past 7-day recall) (17). The enrollees were surveyed on the number of hours spent weekly resting a laptop on their knees, carrying a cellular phone in their pants pockets, and sitting in a sauna. The data collection was supervised by the researchers. We asked each participant to wear a pedometer for a week (Omron HJ-203-EK) to cross-check the data from the questionnaires.

In the next step, the participants were asked to donate blood (after fasting, before 9:00 a.m.) and sperm samples (after 2–7 days of sexual abstinence). The biologic material was acquired during appointed visits to the university-associated laboratories. We collected complete data from 177 subjects. The men who did not deliver semen or blood samples (n = 323) were excluded from the analyses. The entire study was performed in late autumn and winter. We counted the amount of physical activity as multiples of resting metabolic rate by minutes of performance during a week (MET-min/wk = MET Total). Participants reported on activities such as walking, moderate- and vigorous activity and sitting (separately for each type), their frequency (days per week), and duration (time per day). The total score was a sum of minutes and days of walking, with moderate-intensity and vigorous-intensity activity counted separately. According to the IPAQ criteria, the physical activity of a person who achieves $\geq$600 or $\geq$3,000 MET-min/wk is classified as moderate or high, respectively. Those who do not meet the above-mentioned criteria are classified as physically inactive (17).

### Semen Analysis

The collection of semen for diagnostics and the semen analysis were consistent with the latest guidelines of the World Health Organization (WHO) (15).

The semen samples were collected in the andrology laboratory. The samples were obtained by means of masturbation, ejaculated into a sterile plastic (nontoxic for spermatozoa) container, and placed in an incubator (37°C) during liquefaction.

The ejaculation abstinence time (2–7 days) and the time between sample collection and analysis (30–60 minutes) were recorded in each participant's personal lab report.

All semen samples were analyzed with the use of the Sperm Class Analyzer (SCA; Casa System Microptic) by a single experienced medical analyst according to the WHO 2010 diagnostician laboratory manual. The performance of the laboratory is continually evaluated by means of an external quality assessment program (EQAS Labquality; www.labquality.fi).

The semen analysis included measurements of pH, viscosity, sperm count, sperm concentration, peroxidase-positive cells, and evaluations of the motility, vitality, and morphology of the sperm.

The semen volume was estimated by a weighing method (1 g of weight equals 1 mL of volume). The semen pH was measured with the use of pH indicator strips (Merck). The motility of spermatozoa was evaluated with the use of SCA. The procedure was performed at 37°C with a heated microscope stage. The sperm movement was graded as progressive motility, nonprogressive motility, and immotility. The number of spermatozoa was assessed with the use of SCA and verified manually with the use of the improved Neubauer hemocytometer (examination with phase-contrast optics at ×400 magnification). Eosin-nigrosin staining (Vitalscreen test; Fertipro) was used for the assessment of spermatozoa vitality. Each slide was examined with bright field optics at ×1,000 magnification and oil immersion. A Leucoscreen test (Fertipro) was applied to detect peroxidase-positive leucocytes with the use of the improved Neubauer chamber (evaluation with phase-contrast optics at ×400 magnification).

Sperm morphology was evaluated with the use of SCA and was verified manually (Diff-Quik staining method; Microptic). Examinations were performed with a bright-field objective at ×1,000 magnification and oil immersion. The following types of sperm were identified: normal sperm, pathologic forms, amorphous head sperm, round head sperm, tapered head sperm, double headed sperm, microcephalus