Intensity and type of physical activity and semen quality in healthy young men

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Objective: To study the relationship between intensity of physical activity (PA) and semen quality in healthy young men.
Design: A prospective cohort study with repeated measures for each subject.
Patient(s): Healthy high school and university students who did not regularly smoke tobacco, drink alcohol, or take drugs or medicine, with normal body mass index and abdominal circumference.
Exposure: The participants underwent urologic visit, fasting blood and semen sampling, and anthropometric measurements, and filled in the International Physical Activity Questionnaire, at enrollment and after 4 and 8 months. Duration and frequency of walking, moderate-intensity, and vigorous-intensity activities in the last week were assessed, and a score was computed for total PA.
Main Outcome Measure(s): Semen specimens were taken at each visit through masturbation, after 3–5 days of abstinence, and analyzed by an expert urologist. Sperm concentration, total and progressive motility, and proportion of spermatozoa with normal morphology were measured. Linear and generalized linear mixed models with the Poisson family were fitted to assess the relationships between PA variables and sperm parameters, after adjusting for season, time, and study arm. The shape of the relationship was modeled through restricted cubic spline regression.
Result(s): A total of 143 male subjects, aged 18–23 years (median, 20 years), were enrolled. They had a median PA of 1,960 (95% confidence interval, 1,055–3,182) Metabolic Equivalent of Tasks in min/wk. Statistically significant differences were found for total, progressive motility, and percent of cell with normal morphology across categories of total PA; the highest medians of total (47%) and progressive motility (34%) and of the percentage of normal morphology cells (7%) were found for medium PA. Positive associations of sperm total motility and normal morphology with medium levels of PA, and negative associations with walking and vigorous-intensity activity emerged. Spline regression analysis confirmed these findings, showing an inverse U-shape relationship, with the highest value of total motility and normal morphology for medium PA, and the lowest values for lower and higher activity.
Conclusion(s): These findings support the present recommendations to practice moderate PA for health improvement, including semen quality. (Fertil Steril® 2025;123:88–96. ©2024 by American Society for Reproductive Medicine.)
El resumen está disponible en Español al final del artículo.

Key Words: Semen quality, semen analysis, physical activity, IPAQ, cohort study

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A decline in semen quality in the last decades has been documented, possibly due to increased rates of obesity, poor diet, and exposure to environmental toxins, although its causes are still debated (1). Recreational physical activity (PA) has been associated with positive effects on human health, from prevention of chronic diseases to overall well-being, and it is highly recommended by the World Health Organization (WHO) and Scientific Societies (2–4).

A beneficial impact of PA on semen quality has been hypothesized, because of its favorable metabolic and endocrine effects (5). On the other hand, excessive PA can determine poor semen quality and reduced fertility, possibly due to reduced hypothalamus-pituitary-gonadal axis function, and increased oxidative stress and chronic inflammation (6–8).

However, the studies on PA and semen quality have provided contrasting results, with very high heterogeneity among them, according to a recent meta-analysis (9). The differences in type, intensity, and frequency of PA, as well as an inadequate control for confounding because of other factors that influence spermatogenesis including lifestyle and environmental factors (10), may be responsible for the inconsistent evidence on this topic at present. To add more information on this matter, we performed a cohort study aimed to assess the relationship between the intensity of PA and semen quality in healthy young men, taking into account the major risk factors for low semen quality.

METHODS

Study design

This is a prospective cohort study with repeated measures for each subject, as a part of the Fertilità, Ambiente, alimentazione, STile di vita (FASt) study, a randomized controlled trial (clinicaltrials.gov Protocol Registration and Results System; receipt release date: February 15, 2019; no. J59D160013 2001) that aimed to evaluate the effects of a dietary and PA intervention on the semen quality of healthy young men living in three areas of Italy, including Brescia, as detailed elsewhere (11, 12) and summarized in Supplemental Materials (available online). The participants underwent urologic visits, fasting blood and semen sampling, and anthropometric measurements, and filled in some questionnaires on dietary habits and PA at baseline (T0) and after 4 (T4) and 8 (T8) months since the first visit.

Population

Tobacco smoking, alcohol drinking, recreational drug use, and obesity have been recognized as risk factors for reduced male fertility (13). As regards obesity, the commonly used definition of body mass index (BMI) >30 may lead to misclassification of obese people, due to variable proportions of body fat and nonfat masses. Indeed, various studies found that subjects with central obesity, defined as elevated waist circumference, waist-to-hip ratio, or waist-to-height ratio, most of which had a BMI of 25–30, were associated with reduced semen quality (14–16).

Therefore, to avoid possible confounding for poor semen quality, a strict selection of potential candidates was done, according to the following inclusion criteria: residence in the Brescia province, North Italy, no surgery for varicocele done in the previous 6 months, no history of chronic diseases, no regular use of tobacco, alcohol, drug or medicine, no intake of dietary supplements, and absence of overweight/obesity (BMI >25 or waist circumference >102 cm).

High school and University students were invited to participate after an explanation of the rationale and methods of the study in short meetings taken in the classrooms in 2018–2019. All the subjects received some advice regarding diet and PA, according to present guidelines (17). Furthermore, 71 participants were randomly assigned to the intervention arm of the randomized controlled trial and therefore received personalized advice on their dietary habits in the first 4 months of the study (from T0 to T4).

We conducted the study according to the Declaration of Helsinki. The protocol was approved by the Ethic Committees of Brescia Province. All the participants were volunteers who signed an informed consent form. All the data were collected and analyzed in accordance with the Legislative Decree no. 196 of June 30, 2003 “Personal Data Protection Code” and the new European Data Protection Regulation 2016/679 (EU).

Questionnaires

PA was evaluated using the International Physical Activity Questionnaire (IPAQ) (18, 19), which assesses specific types of activity, i.e., walking, moderate-intensity and vigorous-intensity activities, and calculates the Metabolic Equivalent of Tasks (METs). The duration and frequency of walking, moderate-intensity, and vigorous-intensity activities were measured according to the protocol (18), and a score in METs-min/wk was computed by multiplying the duration of the activity, in min/wk, and the METs specific for each type of activity. A total score of PA was then calculated by adding the scores of walking and moderate and vigorous activities, and then subjects were classified into three categories: low (<600 METs), medium (600–2,999 METs), and high (≥3,000 METs) PA. The participants’ dietary habits were investigated using the PREvención con DIeta MEDiterránea (PREDIMED) questionnaire (see Supplemental Materials), which assesses the frequency of intake of foods typical of the Mediterranean diet and those of the “Western” diet, providing an overall 0–14 score (20).

Biological and anthropometric measures

A fasting blood sample was taken for each participant for the analysis of glycemia, cholesterolemia, and other biochemical parameters, to exclude the presence of chronic diseases that could have influenced the participants’ semen quality. As abdominal fat is a well-defined risk factor for poor semen quality and low male fertility (21), height, weight, and waist and abdominal circumferences were measured by trained nutritionists at each visit. The BMI was computed as weight in kilograms divided by height in meters squared. Testicular volume was not assessed by ultrasound examination. Anyway, no subjects showed testicular hypotrophy or atrophy or other diseases on clinical evaluation done by an expert urologist.

Semen quality assessment

Fasting blood and semen specimens were collected early in the morning at each visit, at baseline (T0), and after 4 and 8 months from the enrollment (T4 and T8, respectively). Semen samples were collected through masturbation, after ≥ 3 days and at most 5 days of abstinence. The semen samples were processed immediately and analyzed by the study urologist, according to the WHO Manual 2010 (22): a microscope for optical evaluation, with a Makler counting chamber, and two automated semen analyzers (SQA-V GOLD, Medical Electronic Systems Ltd., Petah Tikva, Israel, and the Lenshooke Semen X1 Pro system, Bonraybio Co., Ltd., Taichung, Taiwan), equipped with a microscopic integrated optics were used. The sample volume, sperm concentration, total motile sperm count, total and progressive motility, and proportion of spermatozoa with normal morphology were assessed.

Statistical analyses

The study participants' characteristics and semen parameters were described through median and interquartile range in the entire sample and across PA categories (low, medium, and high). A linear mixed model with robust variance estimation was fitted to assess the relationships between IPAQ variables and sperm concentration, although a generalized linear mixed model with the Poisson family was used to evaluate cell motility and morphologically normal spermatozoa count (23), with overall cell number as the offset. Mixed models allow us to take into consideration the within-subject correlation of data collected at T0, T4, and T8, as well as data variation between subjects.

The linear models provided coefficients as measures of association, with positive and negative coefficients indicative of improvement and decline in sperm concentration, respectively, whereas the Poisson models provided incidence rate ratios as measures of associations, with values greater or lower than 1 indicative of improvement and decline in sperm motility or morphologically normal cells, respectively. Some studies found a relationship between seasonal parameters, particularly temperature and humidity, and semen quality (24–26); therefore, all the models were adjusted for season, as well as, time and FASt study arm (intervention/control).

Restricted spline regression models were fitted to model the potential nonlinear shape of the associations between total PA and semen parameters. A P value $<.05$ was deemed to be statistically significant. All the statistical analyses were performed with R, version 4.2.1.

RESULTS

A total of 143 male subjects, aged 18–23 years (median 20 years) were enrolled. They had an anthropometric, urological, and biological evaluation, and provided valid questionnaires at baseline (T0). Their characteristics are shown in Table 1. Most of them were engaged in medium (45%) or high (43%) recreational PA, with relatively high METs-min/wk. As regards semen quality, statistically significant differences were found for total, progressive motility and % of cell with normal morphology across categories of total PA. The highest medians of total (47%) and progressive motility (34%) and of the percentage of normal morphology cells (7%) were found for medium PA. No statistically significant differences were found for volume, sperm concentration, or total motile sperm count.

Of the 143 subjects with baseline evaluation, 130 underwent the T4, and 117 also the T8 evaluation. The reasons for the withdrawal of subjects at T4 and T8 evaluations were lack of time and logistic problems. At baseline, there was no statistically significant difference between the 117 subjects who completed the three visits and the 26 who did not (18% of the total enrolled) for all the variables listed in Table 1 (data not shown).

None of the subjects showed alterations in the metabolic syndrome parameters. Data on systolic and diastolic blood pressure, glycemia, and serum levels of high density lipoproteins, low density lipoproteins total cholesterol, and triglycerides are reported in Supplemental Table 1. No association was found between the parameters of the metabolic syndrome and semen quality parameters.

Although sex hormone analysis was not an aim of the study, it was performed in a sample of 58 participants at baseline. Descriptive statistics of sex hormones are shown in Supplemental Table 1. No significant differences were found for testosterone and the other hormones according to total PA level, apart from sex hormone binding globulin, with the highest values of sex hormone binding globulin in the medium category of total PA. No associations were found between testosterone serum levels and sperm parameters at baseline, as reported in Supplemental Table 2.

Model results of the associations between total PA, its categories (low, medium, and high), and type (walking, moderate, vigorous) with semen quality parameters are shown in Table 2. Positive associations of sperm total motility and normal morphology with medium PA and negative associations with walking and vigorous-intensity PA were found. No association was evident between sperm concentration and PA.

The restricted spline regressions of semen parameters by METs of total PA are shown in Figure 1. An inverse U-shape relationship was observed, with the highest value of semen parameter for intermediate values for total sperm motility and normal morphology. No statistically significant trend was evident for sperm concentration, despite an apparent U relationship derived from the restricted cubic spline model.

Finally, to compare subjects who showed and those who did not show an improvement in semen parameters in the study period, we established a cutoff of $\geq 10\%$ increase for each parameter from baseline to 4-month assessment. A total of 36 boys showed an improvement in total sperm motility and 90 did not. As shown in Supplemental Table 3, the subjects with $\geq 10\%$ improvement in total sperm motility were slightly younger (19 vs. 20 year of age) and had one point lower PREDIMED score, compared with subjects who did not have an improvement in total motility. No significant differences between the two groups were found for the PA level or the other sperm parameters.

TABLE 1

Baseline characteristics and semen parameters of 143 healthy young men living in Lombardy, North Italy, according to total physical activity.

Characteristic	Overall (n = 143)[a]	Total physical activity: Low (n = 17)[a]	Medium (n = 65)[a]	High (n = 61)[a]	*P* value
Baseline characteristics					
Total physical activity (MET-min/wk)[a]	1,960 (1,055–3,182)	455 (264–480)	1,260 (1,038–1,830)	3,420 (2,640–4,500)	< .001
Age (y)[a]	20.0 (19.00–21.00)	20.00 (19.00–21.25)	20.00 (19.00–21.00)	20.00 (19.00–21.00)	.9
PREDIMED score[a]	7.00 (5.00–8.00)	6.00 (5.00–7.00)	7.00 (5.00–8.00)	8.00 (6.00–9.00)	.007
BMI (kg/m^2)[a]	22.2 (21.10–24.20)	21.40 (19.50–22.00)	22.10 (20.70–24.40)	22.7 (21.60–24.10)	.012
Waist circumference (cm)[a]	77.0 (74.0–81.0)	76.0 (72.0–80.0)	77.0 (72.0–81.0)	77.0 (75.0–81.0)	.2
Abdominal circumference (cm)[a]	84.0 (79.0–87.0)	86.0 (80.0–88.0)	84.0 (78.0–87.0)	85.0 (80.0–87.0)	.5
Semen parameters					
Volume (mL)[a]	3.00 (2.00–3.35)	2.50 (2.50–3.50)	3.00 (2.00–3.50)	3.00 (2.00–3.00)	.2
Sperm concentration (10^6/mL)[a]	62 (27–98)	80 (55–103)	53 (24–92)	66 (33–97)	.12
Total motile sperm count (10^6)[a]	55 (21–105)	57 (37–128)	55 (27–96)	55 (17–106)	.7
Total motility (%)[a]	46 (28–53)	37 (26–45)	47 (37–55)	45 (23–53)	< .001
Progressive motility (%)[a]	31 (14–41)	23 (10–33)	34 (17–42)	31 (14–41)	< .001
Cell with normal morphology (%)[a]	6.0 (3.0–10.0)	5.0 (3.0–7.0)	7.0 (4.0–10.0)	6.0 (3.0–10.0)	< .001

Note: BMI = body mass index; IQR = interquartile range; MET = Metabolic Equivalent of Tasks; PREDIMED = PREvención con DIeta MEDiterránea.
Total physical activity: low: <600 METs, medium: 600–2,999 METs, and high: ≥3,000 METs.
[a] Median (IQR).

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DISCUSSION

We found an inverse U-shape association between PA and semen total motility and morphology in normal-weight, nonsmoking, and nonalcohol-drinking healthy young men. The highest levels of semen quality parameters were observed in subjects who practiced medium PA (600–2,999 METs-min/wk), whereas the subjects with lower or higher PA levels had lower values of the semen quality parameters. No statistically significant trend was found for sperm concentration, despite an apparent U relationship.

Our findings are in agreement with several studies on healthy young men of the general population or male partners of infertile couples, showing that men who are engaged in moderate-to-high PA tend to have better semen quality compared with those with sedentary behavior or with high PA (27). In addition, a study using an accelerometer to measure PA in men attending an infertility clinic found that individuals with an average number of 10 min-bouts of moderate-to-vigorous PA had better semen quality than those who engaged in lower or higher numbers of bouts of activity (28). Accordingly, a recent meta-analysis concluded that a moderate-to-high PA level reduces the risk of infertility in both men and women (29).

A medium level of PA can be reached by adults doing moderate-intensity or vigorous-intensity aerobic PA, and also muscle-strengthening activities, according to the WHO guidelines (30). No consistent evidence exists on the effects of specific sports or types of PA (9). A positive effect of PA on semen quality and male human fertility may be due to a reduction of stress hormones and antioxidant and anti-inflammatory activity, because oxidative stress is a well-established cause of sperm damage and male infertility (31), although no definite mechanism of the effect of PA has been established so far.

So far, the results of epidemiological studies on the association between PA and semen quality have been inconsistent. Some studies showed beneficial effects of moderate-to-vigorous PA on sperm concentration or total count, but not on sperm motility or morphology (32–34). Another study found positive associations with progressive and total sperm motility and no other parameters (35), whereas others found no associations, or inverse associations, with semen quality parameters (8, 27, 36–38). Accordingly, also the studies on the impact of PA on both female and male fertility reported contrasting results, with some of them showing an inverse U-shape association between PA and male or female fertility similar to that we observed between PA and semen parameters (39). These discrepancies may be due to differences in study power, selection of participants, study design, methods of measuring PA, choice of the semen parameters, and confounding by other variables because many factors have been found to influence semen quality (40). Randomized controlled trials may provide more sound data, but they are relatively few and most of them had a small sample size. Furthermore, the results of randomized controlled trials may be biased by the concurrent reduction of subjects' body fat mass, because of the intervention, since overweight/obesity has a negative impact on male fertility and semen quality by itself (21).

This study has some strength. First, we made a strict selection of participants, from a relatively homogeneous setting (high school and university students), to avoid confounding factors associated with low semen quality, including lifestyle,

TABLE 2

Association[a] between physical activity levels measured by International Physical Activity Questionnaire and semen quality parameters.

Physical activity	Sperm concentration[a]			Sperm total motility[a]			Sperm progressive motility[a]			Sperm normal morphology[a]		
	β	95% CI	P value	IRR	95% CI	P value	IRR	95% CI	P value	IRR	95% CI	P value
IPAQ (×1,000 METs-min/wk)	−0.15	−2.4 to 2.1	.90	0.97	0.96–0.99	<.001	0.98	0.97–1.00	.11	0.98	0.95–1.02	.34
Total physical activity												
Low		Reference			Reference			Reference			Reference	
Medium	−12	−26 to 1.9	.089	1.20	1.10–1.30	<.001	1.18	1.07–1.31	<.001	1.23	1.02–1.49	.030
High	−8.2	−22 to 6.0	.26	0.95	0.88–1.03	.24	0.98	0.89–1.08	.66	0.98	0.81–1.19	.87
Type of physical activity												
Walking, METs (×1,000 METs- min/wk)	−3.2	−8.1 to 1.7	.20	0.95	0.90–1.00	.039	0.93	0.87–0.99	.015	0.95	0.84–1.06	.33
Moderate-intensity, METs (×1,000 METs- min/wk)	4.9	−2.2 to 12	.17	1.04	0.99–1.09	.14	1.14	1.07–1.21	<.001	1.06	0.96–1.18	.26
Vigorous-intensity, METs (×1,000 METs-min/wk)	−0.01	−3.2 to 3.2	>.99	0.96	0.94–0.98	<.001	0.97	0.95–1.00	.029	0.98	0.94–1.02	.34

Note: CI = confidence interval; FASt = Fertilità, Ambiente, alimentazione, STile di vita; IPAQ = International Physical Activity Questionnaire; IRR = incidence rate ratio; METs = Metabolic Equivalent of Tasks.
[a] A robust linear mixed regression model was fitted for sperm concentration and a Poisson mixed regression model was fitted for total and progressive motility, cells with normal morphology outcomes. Models were adjusted for season, time, FASt study arm (intervention, control), time* FASt study arm, time*physical activity.

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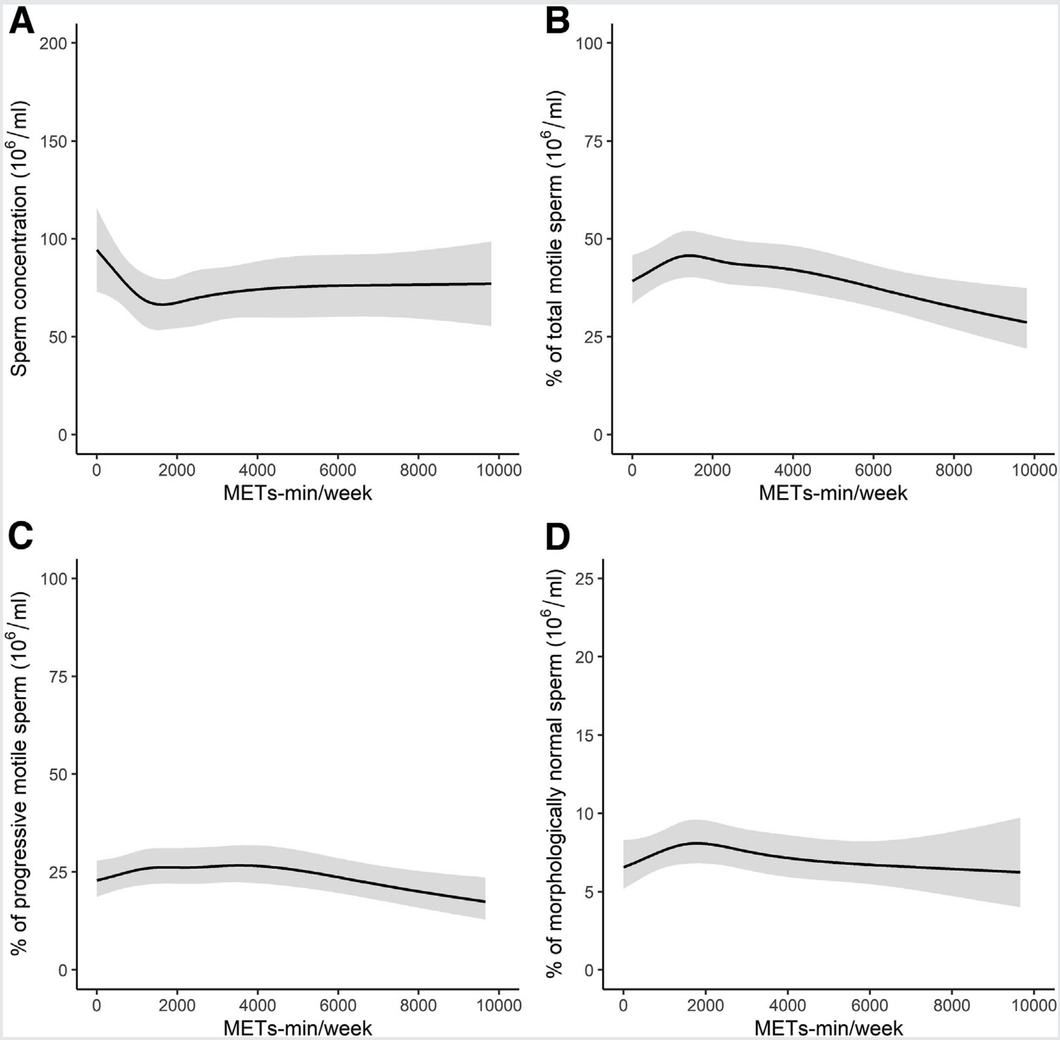
overweight/obesity, presence of chronic diseases, and drug or medicine use. Second, we performed a population-based study, as we enrolled students living in the Brescia province that can be representative of the general population living in the area, without knowing their semen or fertility status (blind enrollment). Since participation in the study was voluntary, a selection of the healthier subjects living in the area cannot be excluded, but their semen quality parameters were not high, according to the WHO reference values, therefore it is unlikely that they were not representative of healthy young people of the general population. Third, we assessed PA with IPAQ, an internationally validated tool widely used in epidemiologic research, which allows measuring the levels of moderate-intensity and vigorous-intensity PA. Fourth, we analyzed more than one measure of semen samples and questionnaires for most subjects, thus increasing the estimate precision. Finally, all the models in our analysis were adjusted for season, because we found a negative effect of winter compared with the other seasons. The negative effects of winter on semen quality might be due to various factors: a negative effect of the combined low temperature and high humidity, which was found in some but not all studies (24–26); the longer length of the dark period in winter, that determines a long nightly peak of melatonin secretion, known to inhibit the HPG axis and the GnRH-induced LH release necessary to trigger testosterone production (41, 42); and the concurrent lower ambient air quality in the coldest months of the year in the Po Valley, one of the areas with the highest levels of PM10 and PM2.5 in Europe (43), which have been associated with lower semen quality in various studies (44).

This study has some limits, too. First, the lack of objective measures of PA, because assessment of PA was based on self-administration of the IPAQ, although each subject filled in the questionnaire under the supervision of a dietician. The properties of the IPAQ short form have been assessed in various studies, and it was found to have good reliability and acceptable validity for walking and vigorous activity when it was compared with objective measures of PA by accelerometer and/or pedometer (45). Second, we enrolled high school and university students in our study, which may be of concern as regards the generalizability of the results. However, students usually spend much time sitting and looking at screens and have substantially homogenous lifestyles, similar to those of young working people, in Italy. Indeed, several studies on sperm quality of healthy young people included only, or mainly, students (7, 32, 38), and their findings have been analyzed together with those of studies on healthy people of the general population in a recent review (9). Lastly, we measured hormone levels only in a subgroup of subjects and did not assess testicular volume, which might be confounders in the relationship between PA level and semen parameters. However, in the 58 subjects analyzed, hormone levels showed no association with PA or semen quality. Regarding testicular size, no subject had testicular hypotrophy or atrophy or other diseases at the clinical evaluation by an expert urologist at the enrollment.

In conclusion, our study shows an inverse U-shape association of recreational PA with semen quality in healthy young men, with the highest levels of sperm total motility and normal morphology in subjects with medium PA, and

FIGURE 1



Spline functions between IPAQ score and semen quality parameters. (**A**), sperm concentration; (**B**), sperm total motility; (**C**), sperm progressive motility; and (**D**), sperm normal morphology. IPAQ = International Physical Activity Questionnaire; METs = Metabolic Equivalent of Tasks.

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lower figures for those with lower or higher PA. As semen quality is strongly related to male fertility, these results suggest that medium PA may be helpful for preventing and correcting male infertility, although the limits of our study, particularly possible confounding by other healthy behaviors, cannot be excluded. Therefore, large well-conducted observational or experimental studies are needed to draw definite conclusions for evidence-based recommendations about practicing PA to improve reproductive health.

CRediT Authorship Contribution Statement

Francesco Donato: Conceptualization, Methodology, Supervision, Validation, Writing – original draft. Matteo Rota: Formal analysis, Writing – review and editing. Elisabetta Ceretti: Data curation, Investigation, Methodology, Writing – review and editing. Gaia Claudia Viviana Viola: Investigation, Methodology. Monica Marullo: Investigation. Danilo Zani: Investigation. Stefano Lorenzetti: Conceptualization, Methodology, Supervision, Writing – review and editing. Luigi Montano: Conceptualization, Funding acquisition, Methodology, Project administration, Writing – review and editing.

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Declaration of Interests

F.D. has nothing to disclose. M.R. has nothing to disclose. E.C. has nothing to disclose. G.C.V.V. has nothing to disclose.

M.M. has nothing to disclose. D.Z. has nothing to disclose. S.L. has nothing to disclose. L.M. has nothing to disclose.

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Intensidad y tipo de actividad física y la calidad del semen en hombres jóvenes sanos.

Objetivo: Estudiar la relación entre la intensidad de la actividad física (AF) y la calidad del semen en hombres jóvenes sanos.

Diseño: Estudio de cohorte prospectivo con medidas repetidas para cada sujeto.

Entorno: No aplicable.

Paciente(s): Estudiantes de secundaria y universitarios sanos que no fumaban tabaco, bebían alcohol ni consumían drogas o medicamentos con regularidad, con índice de masa corporal y circunferencia abdominal normales.

Intervención(es): Los participantes se sometieron a visita urológica, muestreo de sangre y semen en ayunas, mediciones antropométricas y completaron el Cuestionario Internacional de Actividad Física, al momento de la inscripción y después de 4 y 8 meses. Se evaluaron la duración y la frecuencia de las actividades de caminata, de intensidad moderada y de intensidad vigorosa en la última semana, y se calculó una puntuación para la AF total.

Principales medidas de resultado: Se tomaron muestras de semen en cada visita mediante masturbación, después de 3 a 5 días de abstinencia, y fueron analizadas por un urólogo experto. Se midieron la concentración de espermatozoides, la motilidad total y progresiva y la proporción de espermatozoides con morfología normal. Se ajustaron modelos mixtos lineales y lineales generalizados con la familia Poisson para evaluar las relaciones entre las variables de AF y los parámetros de los espermatozoides, después de ser ajustados por estación, tiempo y brazo de estudio. La forma de la relación se modeló mediante regresión cúbica por spline restringida.

Resultado(s): Se inscribieron un total de 143 sujetos masculinos, de entre 18 y 23 años (mediana, 20 años). Tenían una mediana de AF de 1.960 (intervalo de confianza del 95 %, 1.055–3.182) equivalente metabólico de tareas en minutos/semana. Se encontraron diferencias estadísticamente significativas para la motilidad progresiva total y el porcentaje de células con morfología normal en todas las categorías de PA total; las medianas más altas de motilidad total (47%) y progresiva (34%) y del porcentaje de células de morfología normal (7%) se encontraron para la AP media. Surgieron asociaciones positivas de la motilidad total de los espermatozoides y la morfología normal con niveles medios de AF, y asociaciones negativas con caminar y actividad de intensidad vigorosa. El análisis de regresión por spline confirmó estos hallazgos, mostrando una relación en forma de U inversa, con el valor más alto de motilidad total y morfología normal para la AF media, y los valores más bajos para la actividad más baja y más alta.

Conclusión(es): Estos hallazgos respaldan las recomendaciones actuales de practicar AF moderada para mejorar la salud, incluida la calidad del semen.