

Sport activity in adolescence: associations with health perceptions and experimental behaviours

C. Ferron, F. Narring, M. Cauderay and P.-A. Michaud

Abstract

Despite the relevance of this research topic from a public health perspective, there is currently a lack of objective data on European adolescents' sport activity, notably the associations between their sport habits and their health attitudes and behaviours, which may have important consequences both in terms of somatic (cardiovascular) health and mental health. The objective of the present study was to determine the direction and strength of the associations between the frequency of sport and health variables; in particular, perceptions of health, self image, substance use and experimental behaviours. Data were collected as part of the 1993 Swiss Multicentric Adolescent Survey on Health. In this survey, anonymous self-administered questionnaires were distributed to a national representative sample of 10 000 in-school adolescents (15–20 years of age). Univariate analyses explored the relationships between the level of sport activity and health variables; then logistic regression analyses examined the strength of these relationships. According to the results, half of the sample do sports more than twice a week, boys more often as part of a sports club. Differences between non-athletic and athletic adolescents describe the latter as having less somatic complaints, more confidence in their future health, a better body image, a lesser tendency to attempt suicide, a higher

frequency of use of the car seat belt, and a lower use of tobacco, wine and marijuana. Links between the frequency of sport activity and the locus of control related to health, general satisfaction with life or sexual behaviours are less strong. It must be noticed that the cross-sectional data collection precludes the establishment of a causal relationship between exercise and health behaviours. However, the existing links underline the coexistence of positive health characteristics and sport activity, suggesting that an incitement to get involved in physical activity may be a necessary component of a comprehensive prevention approach among adolescents.

Introduction and objectives

Previous research has shown that strong links exist between health status and physical activity, sport practice and level of fitness, including during childhood and adolescence (Bouchard *et al.*, 1988; Baranovski *et al.*, 1992; Rowland and Freedson, 1994; Craig *et al.*, 1996). The potentially negative consequences of a sedentary lifestyle in the long term were also demonstrated (Bouchard *et al.*, 1988; Baranoski *et al.*, 1992).

The perception of the involvement in physical activity and sports as a protective factor against stress and depression or unsettling behaviours (notably risk taking, experimental behaviour and drug use) is currently spreading among health professionals and policy makers. Specifically, both perception of personal efficacy and motivation seem to be significantly and positively correlated with physical exercise (Dishman, 1985). Likewise,

Institut Universitaire de Médecine Sociale et Préventive,
Bugnon 17, 1005 Lausanne, Switzerland

a low level of involvement in a sport activity appears to be linked to a tendency to adopt experimental behaviours in several particular areas, e.g. the frequency of cigarette smoking or marijuana use is inversely correlated with the frequency of sport activity among adolescents (Ilmarinen *et al.*, 1988; Abel *et al.*, 1992; Rothlisberger, 1994; Pate *et al.*, 1996).

The assumption that sports practice is a resiliency or rehabilitation factor as regards health, mental health and substance use has led some professionals to build prevention programs based on the promotion of sports activities. In Switzerland, for example, the 'No Drugs—More Sports!' program included projects of primary ('Participate'), secondary ('Move') and tertiary ('Start') prevention of substance abuse (Bundesamt für Gesundheitswesen, 1992–96; Gervasoni *et al.*, 1996). Before the implementation of these programs on a large scale, it seems relevant to take a closer look at the link between exercise and mental health as well as experimental behaviours in adolescence. The existence of a large dataset focusing on various aspects of health and lifestyles among Swiss adolescents (Narring and Michaud, 1995) gave us the opportunity to explore this link. The present study was designed in order to determine the associations between the frequency of sports and health variables; in particular, perceptions of health, self image, substance use and experimental behaviours. Our main hypothesis was that athletic adolescents would be less likely to expose themselves to health risks than others and that exercise would be part of a healthy lifestyle adopted with the future in mind.

Method

The data were collected as part of the Swiss Multicentric Adolescent Survey on Health (SMASH) study. This national survey was conducted by means of a self-administered health and lifestyle questionnaire of 87 items, and involved a sample of 9268 young people (15–20 years old) attending post-mandatory school in Switzerland (Narring *et al.*, 1994). Youngsters who attend

schools represent 80–90% of the whole population of adolescents aged 15–20 years in Switzerland (Narring and Michaud, 1995). Respondents were selected via one-stage random cluster sampling, the class of students being the sampling unit. The anonymous questionnaires were presented to the students in their classrooms by people who were not themselves involved in the school system and the students' participation was on a voluntary basis. Only two adolescents refused to participate. High response rates (95–97%) were obtained for most of the questions, including those pertaining to sports activity. More details on study design and execution, as well as precise information on the sampling method, are given elsewhere (Narring and Michaud, 1995). The characteristics of the whole sample are summarized in Table I.

In the SMASH survey, the questions about physical activity were formulated in two ways. The first question focused on the frequency of sport activity and the second one on belonging to a sports club (Table II). The data were analysed in two steps: (1) exploratory univariate analyses, and (2) regression analyses comparing two groups defined as follows: 'athletic adolescents' (adolescents who do sports 2–3 times a week and belong to a sports club, or do sports daily whether or not they belong to a sports club) and 'non-athletic adolescents' (adolescents who do sports once a week or never). The constitution of 'extreme' groups as regards the sport practice was performed in order to obtain a better discrimination of the associated health behaviours and is suited to the nature of the data which were collected as part of the national survey. For instance, the general nature of the question precluded a further differentiation between sports implying strenuous exercise and sports including quieter activities. Chi-square analyses (stratifying by sex) were first performed in order to evaluate the differences and similarities between the already defined groups as regards their reported health status, behaviours, attitudes and perceptions. Variables related to perceptions of health, self image, substance use and experimental behaviours, which appeared to be statistically associated with the level of physical activity, were

Table I. Main characteristics of the sample

Characteristics	Female apprentices (<i>n</i> = 2164) (%)	Male apprentices (<i>n</i> = 3780) (%)	Female high school students (<i>n</i> = 1829) (%)	Male high school students (<i>n</i> = 1495) (%)	All (<i>N</i> = 9268) (%)
Age					
15–16	16.4	18.0	31.8	28.9	29.3
17	31.6	29.8	29.7	26.8	31.0
18	29.7	28.7	22.2	27.7	24.1
19–20	22.3	23.6	16.3	16.7	15.6
Nationality					
Swiss	75.6	76.4	78.0	75.3	76.2
foreign	24.4	23.6	22.0	24.7	23.8
Living area					
urban	41.9	40.4	46.9	52.2	50.4
rural	58.1	59.6	53.1	47.8	49.6
Parents					
live together	79.6	81.6	83.3	83.2	81.8
divorced/separated	20.4	18.4	16.7	16.8	18.2

Table II. Frequency of sport activity

	Boys (%)	Girls (%)	All (%)
Never	13.7	18.1	15.6
Once a week	23.4	35.5	28.7
Between 2 and 3 times a week	37.6	33.3	35.7
Everyday or almost everyday	25.3	13.1	20.0
Totals			
<i>N</i>	5234	3983	9217
%	100	100	100

then entered in a model in order to carry out backstep logistic regressions. These multivariate analyses were performed in order to examine the relative contribution of several characteristics on these health variables. Besides the fact of being ‘athletic’ or ‘non-athletic’, these characteristics were:

- *Age*: 17 years old and less, 18 years old and more.
- *Sex*.
- *Social class*: fathers’ educational status (mandatory school only or further studies) was used as a proxy variable for the respondents’ socio-economic level.
- *Educational status*: although most adolescents

between 15 and 20 years old attend schools in Switzerland, they may follow two different educational paths after mandatory school. We compared ‘students’, who constitute about 30% of the school population and attend high school full-time, with ‘apprentices’, who constitute about 70% of the school population and attend a vocational school 1–2 days a week, the rest of the week being dedicated to professional training. Both were sampled with the same method.

- *Origin*: Swiss or foreign.

Results

Frequency of sport activity in the main sample

About half of the main sample claimed to do sports more than twice a week. A higher proportion of boys did sports in a club (Table II). Among boys as well as among girls, the level of attendance at the club was correlated with the frequency of physical activity. However, 15% of the boys and 30% of the girls who claimed to have a daily sport activity do not belong to such a club (Table III).

As far as frequency is concerned, results of univariate analyses show that boys, high school

Table III. Attendance at a sports club as related to frequency of sport activity

	Attend a sports club			
	Boys (%)		Girls (%)	
	No	Yes	No	Yes
Never	96.4	3.6	97.6	2.4
Once a week	68.9	31.1	76.7	23.3
Between 2 and 3 times a week	26.1	73.9	41.0	59.0
Everyday or almost everyday	14.8	85.2	31.7	68.3
Totals				
N	4919		3703	
%	100		100	

students, adolescents having two Swiss parents, a father with a higher educational status or parents living together have a significantly higher frequency of physical activity than other groups. There is no statistically significant difference according to age (although sport activity tends to decrease with age) or living area (although the adolescents who live in a rural area appear to be more likely to do sports than others).

Sport activity and health

Among health problems which differentiate 'athletic adolescents' and 'non-athletic adolescents', the most clearly significant in the univariate analyses are skin problems, weight and height problems, headaches and stomach-aches, legs pain, sleep problems, and faintness. For all these problems, there is a significantly higher frequency of complaints among 'non-athletic adolescents' ($P < 0.01$). The results of the logistic regression analyses confirm the link between a low level of physical activity and a high frequency of headaches or sleep problems (Table IV); however, gender also plays a crucial role in the frequency of somatic complaints.

Compared to the other group, a higher proportion of 'athletic' youth were confident in their future health (23 versus 7%, $P < 0.001$) and tended to think that health does not depend on chance, but depends on behaviours or personal efforts (32 versus 23%, $P < 0.001$). However, the results

of the logistic regression analyses show that the external attribution of health (i.e. thinking that health is under the influence of uncontrollable factors) is not specifically associated with a low level of sport activity and is more closely related to variables such as origin or social class. On the other hand, the level of confidence placed in future health, although also related to the adolescents' origin, is strongly linked to their level of physical activity (Table IV).

The adolescents' answers to the questions pertaining to psychological adjustment all underline the existence of a superior well-being among those who had the highest frequency of sport activity. As far as the univariate analyses are concerned, the most athletic adolescents appear to be better adjusted, less nervous or anxious, more often full of energy and happy about their life ($P < 0.001$). They less often feel sad, depressed or desperate; moreover, a lower proportion of them report past suicidal thoughts or suicide attempts ($P < 0.001$). Finally, their body image is also more positive: a higher percentage of them was satisfied with their physical appearance and did not wish to change their weight ($P < 0.001$). The results of the logistic regression analyses emphasize the fact that a higher level of sport activity is related to a higher satisfaction with physical appearance, although gender and origin also play a role (Table IV). However, although there seems to be a link between the frequency of sport and the occurrence of a suicide attempt, the relationship of sport activity to the adolescents' mood or satisfaction with life in general appears to be less specific.

The univariate analyses show that, although a significantly higher percentage of 'non-athletic adolescents' claimed that they did not use the car seat belt (36 versus 25%, $P < 0.001$), drinking and driving appears to be just as frequent among them as among 'athletic adolescents' (25%). Also, although the consumption of wine, tobacco and marijuana seems to be less frequent among 'athletic adolescents', they tend to drink beer as often as others (at least once a week: 20%). No significant difference between the three groups could be found relatively to hard drug use—maybe due to the

Table IV. Variables independently associated with sport activity

	Adjusted odds ratio ^a	Confidence interval
Have headaches fairly or very often	0.74	0.51–0.98
Have sleep problems fairly or very often	0.76	0.51–1.00
Are not confident in future health	0.68	0.41–0.95
Unsatisfied with physical appearance	0.69	0.45–0.93
Attempted suicide	0.59	0.25–0.94
Rarely or never use car seat belt	0.78	0.65–0.92
Smoke cigarettes	0.65	0.53–0.77
Drink wine several times a week or more	0.70	0.40–0.99
Lifetime use of marijuana	0.77	0.65–0.90
No contraception use at first intercourse	0.68	0.46–0.89
No condom use at last intercourse	0.68	0.51–0.86

Adolescents who do sports once a week or never: $N = 3250$.

Adolescents who do sports 2–3 times a week and belong to a sports club or do sports everyday: $N = 3482$.

^aEffect of a frequency of sport activity of 2–3 times a week or more.

small size of the concerned subsamples. The results of the logistic regression analyses confirm that a lower level of sport activity is linked to a lower frequency of use of the car seat belt. There is also a strong relationship to tobacco use, wine consumption and marijuana use, all being more frequent among less athletic adolescents (Table IV).

The results of the logistic regression analyses in the field of sexual behaviour show no evidence of a link between the frequency of sports and being sexually active, the number of sexual partners or the regularity of use of a contraception (Table IV). These latter variables appear to be more closely related to the adolescents' gender, age, origin or social class. However, a lower level of sport activity appears to be associated with a higher frequency of two risky behaviours in the field of sexual activity: lack of contraception use at first intercourse and no condom use at last intercourse.

Discussion

Trends in the frequency and intensity of sports activity

Studies of the evolution of the frequency of sport activity with age have generally shown that the amount of time that adolescents give to physical activity tends to decrease as they grow older (Ilmarinen and Rutenfranz, 1980; Lange *et al.*,

1984). According to some authors, the progressive awareness that ability and effort are different notions may lead adolescents to lose interest in sports (Roberts and Duda, 1984; Burton and Martens, 1986). For others, the change in adolescents' perceptions of the potential benefits of physical activity may be the strongest predictor of dropping out of sport (Shepard and Godin, 1988). Disaffection for sports during adolescence is considered by several authors as a normal developmental phase as adolescents make choices between sport and other leisure activity for which their level of success, interest and satisfaction suddenly appears uncertain and inconstant (Burton, 1988; Weiss and Petlichkoff, 1989; Coakley and White, 1992). Some characteristics of adolescents' way of life may also interfere, e.g. the increase in the time spent working or commuting. However, in some cases, this withdrawal could be only temporary (Klint and Weiss, 1986). The decrease in the frequency of sport activity with age, although existing in the Swiss sample, is not statistically significant: a recent (unpublished) survey conducted among adolescents in Switzerland suggests that most of the decrease actually occurs around 15 years old, when Swiss youngsters leave mandatory school and start high school or a professional training.

Data on the frequency of sport activity agree

with other results obtained in a population of young people in Switzerland (Rothlisberger, 1994). According to this latter study, respectively boys and high school students had a weekly and monthly frequency of physical activity higher than girls and apprentices did. This study has also shown that a higher proportion of girls had a moderate physical activity, weekly or monthly. The lesser involvement of the girls in an intense sport activity and their higher rate of moderate sport activity seem to be rather positive in terms of heart disease risk reduction (Gottlieb and Chen, 1985). However, the high percentage of Swiss girls who reportedly never do sports (almost 20%) is worrisome.

Finally, there is a relationship between the adolescents' social context and their level of involvement in a sport activity. All the indicators consistently underline the fact that adolescents with the highest frequency of physical activity belong to a higher social class: their two parents are Swiss, their father studied beyond mandatory school and they attend a high school. The differences between working adolescents and students have been previously reported in an Austrian study and in a Swiss one (Rothlisberger, 1994; Rasky *et al.*, 1996). According to a Canadian study, not only the frequency of sports, but also the strength of the intention to exercise, are closely linked to the socio-economic status of the family (Shepard and Godin, 1988). We may hypothesize that there is a more positive attitude regarding physical activity or sports practice in families with a high socio-economic level.

Sport activity and health

The association of a low level of sport activity with a high frequency of somatic complaints confirms the findings of the other Swiss study (Rothlisberger, 1994).

Among young people who were defined as the most athletic of the sample, there is a clear tendency to consider that an individual's health status depends on personal efforts and that it is possible for an individual to influence his/her own health. These findings are in agreement with those of another study, which has shown that the perception

of personal efficacy and motivation are significantly and positively correlated with physical exercise (Dishman, 1985). Thus, we can hypothesize that the most athletic young people are better inclined to maintain their health status on a satisfying level or better prepared to cope with potential health problems.

The significant relationship between the level of sport activity and all indicators of well-being also confirms the results obtained in numerous other studies. The level of perceived well-being appears to be superior among adolescents who exercise regularly (Folkens and Sime, 1981; Berger, 1984; Rothlisberger, 1994). The enhancing of well-being with the increase in the frequency of sport activity or with the attendance at a sports club is particularly true among male apprentices or male high school students, and among female apprentices (Rothlisberger, 1994). Moreover, a decrease in depressive thoughts and anxiety is generally described as a consequence of an intense physical activity (Markoff, 1982; McCann and Holmes, 1984), which is close to what was found in our sample. Finally, several studies have shown that there is a strong association between adolescents' stress level and involvement in a sport activity. Athletic adolescents have a better adjustment to stressful situations, and this is true no matter their number of practice hours and whether or not they belong to a sports club (Rothlisberger, 1994). Also, adolescent girls who engage in regular physical exercise seem to be less sensitive to the illness-provoking effects of high stress than girls who exercise less (Brown and Lawton, 1986). It seems that physical exercise protects individuals' emotional well-being from the effects of stress (Kobasa *et al.*, 1982). Finally, the most athletic adolescents of the Swiss sample have a better body image than the others, which confirms the results obtained in other countries (Mallick *et al.*, 1987; Pasquis *et al.*, 1987).

Sport activity, substance use and experimental behaviour

A low level of involvement in a sport activity appears to be linked to experimental behaviours in

some particular areas. The fact that little or no involvement in sport activity is associated with failure to wear a seat belt was also demonstrated in a recent US study (Pate *et al.*, 1996). On the contrary, as in the present research, low frequency of sport was found to be unrelated to sexual activity (described on the basis of the number of sexual partners) (Pate *et al.*, 1996).

As far as substance use is concerned, our results on the relationship between tobacco or marijuana use and the level of sport activity agree with those of other studies (Ilmarinen *et al.*, 1988; Abel *et al.*, 1992; Rothlisberger, 1994; Pate *et al.*, 1996): the frequency of cigarette smoking or marijuana use is inversely correlated with the frequency of sport activity among adolescents. However, even if this association of two protective factors as regards cardiovascular health tends to underline the positive role of sport activity, the gender, the type of school and the relational context may also exert a strong influence on substance use. As a matter of fact, the link between sports activity and substance use is not unidirectional: Swiss boys have a greater tendency than girls to use tobacco or alcohol with their athletic friends, and high school students who belong to a sports club drink more beer than others, in our study as well as in another Swiss study (Rothlisberger, 1994). In the US, high physical activity has been shown to be associated with increased alcohol consumption among female students (Pate *et al.*, 1996). A German study based on cluster analyses has found one distinct pattern, common to boys and girls, which is characterized by increased physical exercise, less smoking and increased beer consumption; for young men, the results show the significant influence of higher social class and (paradoxically) positive health attitudes on belonging to this particular cluster (Abel *et al.*, 1992).

Before the implications of these findings are presented, some limitations to the study must be outlined. Firstly, the questionnaire was meant to focus on general health and lifestyles, and was not developed in order to collect precise data on the nature of young people's sport activity or on the intensity of their physical exercise. Secondly,

adolescents' perceptions associated with notions such as 'sport' or 'sports practice', as well as their assessment of their frequency of practising, were not controlled by external criterias. This uncertainty leaves open the possibility of declaration biases linked to the subjective perception of the terms used in the questionnaire and to the respondents' level of social desirability. These problems were partially solved when the subsamples were constituted according to the involvement or non-involvement in a sports club. However, some activities implying a high and regular energy expenditure, e.g. 'techno raves' or cycling to school, may not be considered by young people themselves as a sport activity and may thus escape assessment as part of the inquiry. Also, as already stated, belonging to some clubs may not necessarily imply a high level of sports activity.

One of the strengths of the present study is that it involved a representative sample of adolescents in schools on a national level; moreover, the fact that three different cultural backgrounds (German, French and Italian) are constitutive of this national sample tends to increase the generalizability of the findings. Another interesting point is the consideration of health perceptions and behaviours in relation to sport, instead of the biological characteristics which are usually measured in association with physical activity.

Conclusion and implications

The cross-sectional data collection precludes the establishment of a causal relationship between the varied degrees of involvement in a sport practice and the different health behaviours, attitudes and perceptions. Specifically, on the one hand, sports activity may increase adolescents' self-esteem, and, on the other hand, adolescents with a high self-esteem may be more likely to engage in sports activity. This favourable perception of a high personal value is consistent with the better care that athletic adolescents tend to take of themselves, as it appears in their higher use of the car seat belt, their more frequent condom use, as well as their lower use of cigarettes and cannabis. Thus,

the existing links underline the close relationships between sport activity and some fundamental components of adolescents' health and lifestyle.

On a health promotion perspective, several findings tend to suggest that adolescents' involvement in sport may be a protective factor as regards the use of tobacco as well as illegal drugs. However, only a longitudinal study could demonstrate this causal relationship.

These findings are essential as far as health education is concerned: the fact that health compromising behaviours, as well as health-enhancing behaviours, tend to correlate, suggests that a non-specific prevention approach should be used in adolescent populations. Instead of focusing on the dangers linked to tobacco use, alcohol use or lack of exercise, considered separately, prevention programs, in order to be more effective, should insist on the short- and long-term benefits of a healthy lifestyle, including sport. The encouragement to increase their level of physical activity could thus be used as one element of a set of measures intended to help adolescents improve their physical as well as mental health and well-being.

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References

- Abel, T., Broer, M. and Siegrist, J. (1992) Gesundheitsverhalten bei jungen Erwachsenen: Empirische Analysen komplexer Verhaltensmuster und ihrer Determinanten. *Sozial und Präventivmedizin*, **37**, 293–300.
- Baranowski, T., Bouchard, C., Bar-Or, O., Bricker, T., Heath, G., Kimez, S. Y., Melina, R., Obarzanek, E., Pate, R. and Strong, W. B. (1992) Assessment, prevalence and cardiovascular benefits of physical activity and fitness in youth. *Medicine and Science in Sport and Exercise*, **24**, S237–247.
- Berger, B. G. (1984) Running toward psychological well-being: special considerations for the female client. In Sachs, M. L. and Buffone, G. (eds), *Running as Therapy: An Integrated Approach*. University of Nebraska Press, Lincoln, NE.
- Bouchard, C., Shepard, R. J. and Stephens, T., *et al.* (1988) Exercise, fitness and health: the consensus statement. In Bouchard, C., Shepard, R. J., Stephens T., *et al.* (eds), *Exercise, Fitness and Health*. Human Kinetics, Chicago, IL.
- Brown, J. D. and Lawton, M. (1986) Stress and well-being in adolescence: the moderating role of physical exercise. *Journal of Human Stress*, **12**, 125–231.
- Bundesamt für Gesundheitswesen, Eidg. Sportschule Magglingen (1992–96) Ohne Drogen—Mit Sport! *Prevention of Substance Abuse through Sport Activities, Presentation of the Program*. Bern, 16 pp.
- Burton, D. (1988) The dropout dilemma in youth sports: documenting the problem and identifying solutions. In Malina, R. H. (ed.), *Educational Perspectives*. Human Kinetics, Champaign, IL.
- Burton, D. and Martens, R. (1986) Pinned by their own goals: an exploratory investigation into why young athletes drop out of wrestling. *Journal of Sport Psychology*, **8**, 183–197.
- Coakley, J. and White, A. (1992) Making decisions: gender and sport participation among British adolescents. *Sociology of Sport Journal*, **9**, 20–35.
- Craig, S. B., Bandini, L. G., Lichtenstein, A. H., Schaefer, E. J. and Dietz, W. H. (1996) The impact of physical activity on lipids, lipoproteins and blood pressure in preadolescent girls. *Pediatrics*, **98**, 389–395.
- Dishman, R. K., Sallis, J. F. and Orenstien, D. R. (1985) The determinants of physical activity and exercise. *Public Health Report*, **100**, 158–171.
- Folkens, C. H. and Sime, W. E. (1981) Physical fitness training and mental health. *American Psychology*, **36**, 373–389.
- Gervasoni, J. P., Dubois-Arber, F., Benninghoff, F., Spencer, B., Devos, T. and Paccaud, F. (1996) *Evaluation des mesures de la confederation destinees a reduire les problemes lies a la toxicomanie. Deuxieme rapport de synthese 1990–1996. Version abregee*. Institut Universitaire de Medecine Sociale et Preventive, Lausanne.
- Gottlieb, N. H. and Chen, M. S. (1985) Sociocultural correlates of childhood sporting activity: their implications for heart health. *Social Science and Medicine*, **21**, 533–539.
- Ilmarinen, J., Rutenfranz, J., Kylian, H., *et al.* (1988) Daily physical activity and some health indicators in young workers. In Malina, R. H. (ed.), *Educational Perspectives*. Human Kinetics, Champaign, IL.
- Ilmarinen, J. and Rutenfranz, J. (1980) Longitudinal studies of the changes in habitual physical activity of schoolchildren and working adolescents. In Berg, K. and Eriksson, B. O. (eds), *Children and Exercise*. University Park Press, Baltimore, MD.
- Klint, K. A. and Weiss, M. R. (1986) Dropping in and dropping out: participation motives of current and former youth gymnasts. *Canadian Journal of Applied Sport Sciences*, **11**, 106–114.
- Kobasa, S. C., Maddi, S. R. and Puccetti, M. C. (1982) Personality and exercise as buffers in the stress–illness relationship. *Journal of Behavioral Medicine*, **5**, 391–404.
- Lange Andersen, K., Ilmarinen, J., Rutenfranz, J., *et al.* (1984) Leisure time sport activity and maximal aerobic power during late adolescence. *European Journal of Applied Physiology*, **52**, 431–436.
- Mallick, M. J., Whipple, T. W. and Huerta, E. (1987) Behavioral and psychological traits of weight-conscious teenagers: a comparison of eating-disordered patients and high- and low-risk groups. *Adolescence*, **22**, 157–168.

- Markoff, R. A., Ryan, P. and Young, T. (1982) Endorphins and mood changes in long-distance running. *Medicine and Science in Sport and Exercise*, **14**, 11–15.
- McCann, I. L. and Holmes, D. S. (1984) Influence of aerobic exercise on depression. *Journal of Personality and Social Psychology*, **46**, 1142–1147.
- Narring, F. and Michaud, P.-A. (1995) Methodological issues in adolescent health surveys: the case of the Swiss multicenter adolescent survey on health. *Medecine Sociale et Preventive*, **40**, 172–82.
- Narring, F., Tschumper, A., Michaud, P.-A., Vanelta, F., Neyer, R. and Wydler, H. (1994) *La sante des adolescents en Suisse: rapport d'une enquete nationale sur la sante et les styles de vie des 15–20 ans*. Institut Universitaire de Medecine Sociale et Preventive, Lausanne.
- Pasquis, P., Weber, J., Hannequin, D., et al. (1987) L'image du corps chez les adolescents sportifs. *Sciences et Sports*, **2**, 237–239.
- Pate, R. R., Heath, G. W., Dowda, M. and Trost, S. G. (1996) Associations between physical activity and other health behaviors in a representative sample of US adolescents. *American Journal of Public Health*, **86**, 1577–1581.
- Rasky, E., Stronegger, W. J. and Freidl, W. (1996) Die Verteilung von ausgewählten kardialen Risikofaktoren bei erwerbstätigen und lernenden Jugendlichen in ländlichen Regionen der Steiermark (Osterreich). *Sozial und Praventivmedizin*, **41**, 348–358.
- Roberts, G. C. and Duda, J. L. (1984) Motivation in sport: the mediating role of perceived ability. *Journal of Sport Psychology*, **6**, 312–324.
- Rothlisberger, C. (1994) *Sport, Alltagsbewältigung und Seelische Gesundheit von Adoleszenten*. Sportwissenschaftliches Institut, Magglingen.
- Rowland, T. W. and Freedson, P. S. (1994) Physical activity, fitness and health in children: a close look. *Pediatrics*, **93**, 669–672.
- Shephard, R. J. and Godin, G. (1988) Behavioral intentions and activity of children. In Malina, R. H. (ed.), *Educational Perspectives*. Human Kinetics, Champaign, IL.
- Weiss, M. R. and Petlichkoff, L. M. (1989) Children's motivation for participation in and withdrawal from sport: identifying the missing links. *Pediatric Exercise Science*, **1**, 195–211.

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