

Perceived benefits and barriers to physical activity in a nationally representative sample in the European Union

Hans-Joachim Franz Zunft¹, Dietlinde Friebe¹, Brigitte Seppelt¹, Kurt Widhalm², Anne-Marie Remaut de Winter³, Maria Daniel Vaz de Almeida⁴, John M Kearney⁵ and Michael Gibney⁵

¹German Institute of Human Nutrition, Arthur-Scheunert-Allee 114-116, D-14558 Bergholz-Rehbruecke, Germany:

²University Kinderklinik, Wahringer Guertel 18-20, A-1090 Vienna, Austria: ³University of Ghent, Faculty of Agricultural and Applied Biological Science, CISNA/ICFSN, Coupure Links 653, B-9000 Ghent, Belgium:

⁴Curso de Ciencias da Nutricao, R Dr Roberto Frias, 4000-Porto, Portugal: ⁵Institute of European Food Studies, Trinity College, Dublin, Ireland

Abstract

Objective: To examine the attitudes of consumers, in particular their perceived benefits and barriers to physical activity from all EU member states, and having a measure of prevailing levels of activity, inactivity and self-reported body weight and body shape.

Design: Cross-sectional survey using an interview-assisted face-to-face questionnaire.

Setting: The survey was conducted between March and April 1997 in the 15 member states of the EU.

Subjects: Overall, 15 239 EU subjects, classified according to sex, age (six levels) and highest level of education attained (primary, secondary or tertiary), completed the survey. Sample selection of subjects in each EU member state was quota-controlled to ensure they were nationally representative.

Results: The most important motivation for people to participate in physical activity is to maintain good health (42%), to release tension (30%) and to get fit (30%). The importance of the health argument is highest in older persons and in subjects with a primary education level. Only 13% of the EU population (16% of women, 10% of men) perceived losing weight as a benefit of physical exercise. The most important barriers to increase physical activity are work or study commitments (28%) and the subjects' belief that they are not 'the sporty type' (25%). There is considerable between-country variation in the answering pattern within the EU.

Keywords
Physical activity
Exercise
Sports
Health
Body weight
Body shape
Consumer attitudes
Motivation
Benefits
Barriers

Obesity is a serious and chronic medical condition associated with a wide range of life-threatening diseases and resulting in enormous financial costs being born by health-care systems and the community itself. The prevalence of obesity in the affluent societies has also been increasing during recent years^{1,2}. Therefore, public health programmes focused on a long-term control of body weight are highly relevant. Their main target has to be a concomitant change in dietary habits and in the level of physical exercise^{3–10}. A positive health effect of increased physical activity has been shown for other outcomes^{11–13}.

Many epidemiological studies have demonstrated a close relationship between physical activity and morbidity and mortality from cardiovascular diseases^{14–16}. Regular physical exercise clearly promotes health and well-being and is important in the prevention of cardiovascular diseases. Positive effects are especially observed on the retardation of

atherosclerotic processes and the reduction of high blood pressure¹⁷. Moreover, the risk of other diseases is also influenced in a favourable way. Increased physical activity improves bone structure and contributes to the prevention of osteoporosis and may help to control body weight and normalize insulin sensitivity and glucose tolerance^{18–22}.

Until now, the long-term success of strategies to change lifestyle and to increase the physical activity level has been insufficient. The reasons for the failure in these programmes are not so well-known. Therefore, in order to develop more successful public health strategies, it is necessary to investigate the reasons driving people to a certain nutritional and/or physical behaviour, to recognize the attitudes of individuals towards the recommendations of health promotion programmes and to determine the interrelationship between benefits and barriers motivating or demotivating people to participate in such programmes. To

answer these questions a study was performed in the 15 EU countries.

Methods

The study design and methods of sampling have been described in detail elsewhere²³. In brief, a questionnaire including 12 close-ended questions on attitudes to physical activity, body weight and health was developed by a scientific group headed by the Institute of European Food Studies (IEFS), Dublin, Ireland. Approximately 1000 adults, aged 15 and upwards, from each EU member state were selected to complete the interview-assisted face-to-face questionnaire. Overall, 15 239 subjects in the EU completed the questionnaire. The interviews were carried out as a part of 'Eurobus'. In each member state, subject selection was quota-controlled to make the sample nationally representative.

Subjects were classified according to sex, age (six levels) and highest level of education achieved (primary, secondary or tertiary). Results were calculated, on the one hand, for the combined EU sample weighted for population size to ensure that those member states with a small population size were not given undue emphasis in the context of the total EU and, on the other hand, for national profiles in terms of gender, age and regional distribution.

In order to detect relationships between the high number of categorical data delivered by the questionnaires they were analysed by the chi-squared automatic interaction detection algorithm (CHAID) using the program Answer Tree[®] (SPSS Inc.). The data were distributed in disjunct subgroups being defined by predictors for nominal and ordinal dependent variables. The hierarchical order of the subgroups delivered by the program is an estimate of the priority of the independent variables. For each subgroup a response index was calculated representing the ratio of the number of persons having the considered characteristics of the dependent variable in this subgroup related to the entire sample. The results calculated by CHAID analysis are given as an example in Figure 1. In the other cases they are cited in the text.

Results

Perceived benefits

The first question aims to identify what motivates people to participate in physical activity across the EU. The most important perceived reasons or benefits for taking part in physical activity are summarized in Table 1. The top three reasons for participation in physical exercise were 'to maintain good health',

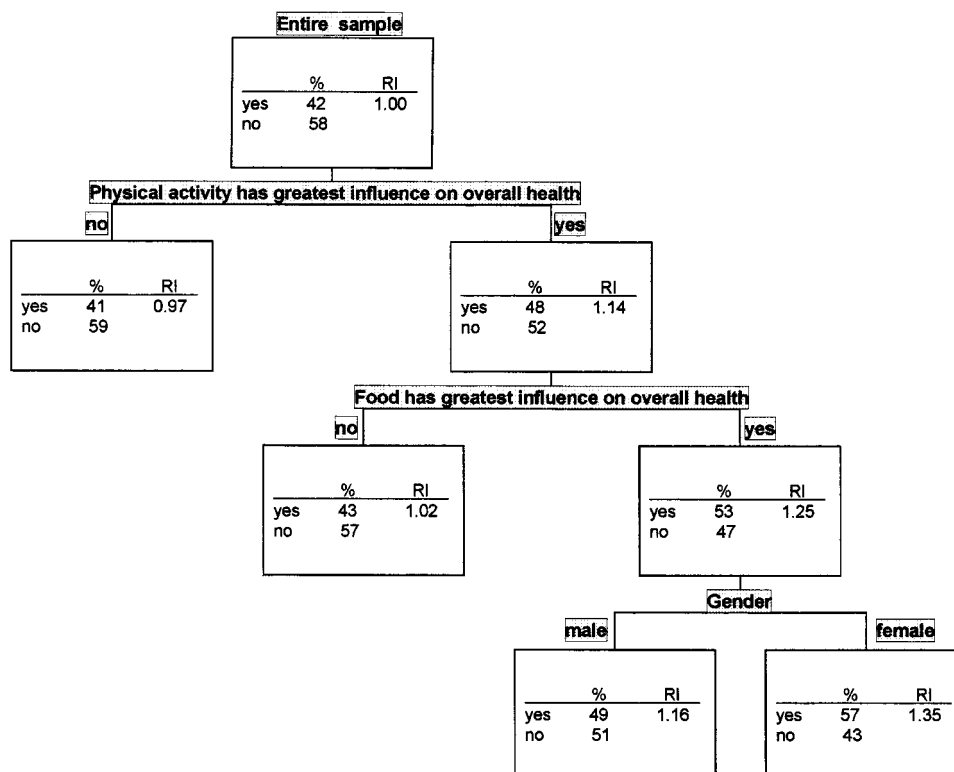


Fig. 1 Percentage of subjects mentioning or not mentioning 'to maintain good health' as a benefit of taking part in physical activity (results of CHAID analysis). RI; response index, i.e. ratio of the percentage of positive answers in a subgroup divided by the percentage of positive answers in the entire sample

Table 1 Percentage of subjects in each member state selecting different perceived motivating factors for participation in physical activity

Country	To maintain good health	To release tension	To get fit	To be out of doors	To socialize	To control weight	For fun	Do not participate
Austria	44	22	21	38	22	9	13	4
Belgium	45	26	33	14	14	12	10	16
Denmark	44	25	22	22	35	9	18	6
Finland	41	33	32	37	9	14	5	<1
France	28	33	29	16	12	7	10	18
Germany	49	24	34	25	13	11	7	7
Greece	49	23	24	9	6	25	8	17
Ireland	38	27	27	32	17	19	14	5
Italy	47	41	27	18	12	15	7	9
Luxembourg	39	27	29	9	16	10	16	14
Netherlands	34	39	26	9	22	13	19	9
Portugal	21	18	8	15	12	7	8	49
Spain	55	38	32	17	13	16	9	4
Sweden	44	16	36	27	15	17	11	5
UK	37	22	34	19	16	15	12	8
EU average*	42	30	30	20	14	13	10	11

* Weighted according to population size.

'to release tension' and 'to get fit'. There was a wide interstate variation in the selections. 'To maintain good health' varied from 21% in Portugal to 55% in Spain. Forty-one per cent of Italian subjects cited 'to release tension' as an important reason for participation in physical activity, compared to 16% of Swedish subjects. Otherwise, Swedish subjects were more concerned about getting fit (36%) while only 8% of the Portuguese saw 'to get fit' as an important motivation factor for participation in physical activity. The proportions of EU respondents believing 'to socialize', 'to control weight' and 'to have fun' were good reasons for participating in physical activity were 14%, 13% and 10%, respectively. The variable 'do not participate in any form of physical activity/exercise' showed the greatest intercountry variation in values ranging from <1% in Finland to almost half of the Portuguese population.

When the motivating factors for participation in physical exercise were examined by the various demographics, 'for good health' was regarded as being the most important variable across all demographics, especially among those aged 55+ years and those with a primary-level education (Table 2).

The factors 'achievement', 'competition', 'concentration' and other and uncertain answers were cited by less than 5% of the subjects and, therefore, are not given in the table.

The individuals mentioning 'to maintain good health' as a reason for physical exercise were analysed by CHAID (Figure 1). The highest response index of 1.35 is found among women recognizing both diet and physical activity as important factors for health. This index means that within this subgroup the portion of individuals believing in a positive health effect of these influencing factors is higher by approximately one-third than in the entire sample questioned. Male individuals with an identical answering pattern show a smaller response index of only 1.16. There is, however, no relationship between these answering profiles to the real physical activity level recorded by the same individuals.

Younger subjects educated to tertiary level were more inclined to choose 'to get fit' (Table 2). While 20% of EU respondents claim that 'to be out of doors' was a motivating factor for taking part in physical activity/exercise, this level rose to 25% for those with primary-level education and to 30% for subjects aged 55+ years.

Table 2 Percentage of EU subjects selecting different perceived motivating factors for participating in physical activity classified by demographics (age, sex and education level)

Motivating factors	Age (years)			Sex		Education level		
	15–34	35–54	55+	Male	Female	Primary	Secondary	Tertiary
To release tension	32	34	21	29	30	23	31	35
To be out of doors	13	19	30	21	19	25	18	16
To maintain good health	39	42	47	41	43	46	40	42
To socialize	15	12	15	14	14	15	14	11
To control weight	15	12	11	10	16	12	14	12
For fun	14	9	4	12	8	6	11	13
To get fit	36	30	23	30	30	26	30	38
Do not participate	8	11	13	9	12	14	10	7

Table 3 Percentage of subjects in each member state selecting 'to release tension' classified by education level and gender

Country	Male			Female		
	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
Austria	22	24	32	13	21	26
Belgium	5	21	43	18	24	40
Denmark	26	35	53	18	23	33
Finland	29	31	37	32	35	49
France	30	34	31	20	32	40
Germany	19	36	34	18	23	28
Greece	15	22	32	13	28	34
Ireland	19	27	27	20	29	42
Italy	25	39	41	35	45	52
Luxembourg	9	26	40	22	33	44
Netherlands	25	38	49	20	38	50
Portugal	13	27	29	9	28	38
Spain	30	38	43	39	50	49
Sweden	8	12	20	14	17	30
UK	7	21	31	14	21	30
EU average*	22	31	34	24	31	37

* Weighted according to population size.

'To control weight' was not perceived to be important in motivating subjects to participate in physical activity. Only 13% of the European population cited this variable, among these more females (16%) than males (10%). The 'to release tension' variable was regarded as more important for younger and middle-aged subjects and those with a secondary and tertiary-level education. This higher choice of 'to release tension' among these groups may be a reflection of their work routine or lifestyle. The percentage of subjects in each member state selecting 'to release tension' classified by gender is shown in Table 3. In almost all member states there was a clear education-related increase for both males and females. Compared to subjects educated to primary or secondary level, subjects with a tertiary-level education were more likely to choose this item as a perceived benefit to participate in physical exercise.

A CHAID analysis revealed that the benefit 'to control weight' was most frequently mentioned (32%) by women perceiving themselves to be overweight and being physically active for 1.5–4.5 hours per week. Only 21% of men with the same characteristics gave this answer. Twenty-three per cent of women and 18% of men wish to reduce their body weight by their effort in physical exercise. Surprisingly, these data do not correlate with the real body mass index (BMI) of the subjects. Among women this motivation slightly increases parallel to the recorded physical exercise, women being active up to 1 hour, 1.5–4.5 hours and more than 5 hours per week mention the factor 'to control weight' with a frequency of 13%, 19% and 16%, respectively. This tendency was not observed among male subjects. There is also a positive relationship between the factor 'to control weight' and the self-estimated BMI of the subjects. Thirty-one per cent of overweight and 26% of obese women expect to

normalize their perceived body weight by being active. Among obese men recording to be active more than 5 hours per week there is also a relatively high percentage (21%) of subjects who expect a normalizing effect on their body weight.

There was an age-related increase in those people selecting the response 'I do not participate in any activity', while the opposite trend occurred with increasing education level with 14% primary-educated subjects versus only 7% of those with a tertiary-level education selecting this variable. This relationship between education level and the selection of 'I do not participate' was examined further across the 15 member states (Table 4). While an education-related decrease occurred in all but one member state (Finland, where less than 1% of respondents with a primary, secondary or tertiary-level education did not engage

Table 4 Percentage of subjects in each member state who selected 'I do not participate in any physical activity/exercise' classified by education level

Country	Primary	Secondary	Tertiary
Austria	6	3	2
Belgium	26	17	9
Denmark	7	4	5
Finland	1	1	1
France	27	18	14
Germany	10	5	3
Greece	30	12	10
Ireland	11	4	1
Italy	12	9	4
Luxembourg	23	9	6
Netherlands	10	10	7
Portugal	61	29	23
Spain	5	2	4
Sweden	6	6	2
UK	13	9	3
EU average*	14	10	7

* Weighted according to population size.

in some form of exercise) there was considerable variation in the strength of decrease from a gradual decrease in Denmark, the Netherlands and Spain to a large reduction in Belgium, Greece, Luxembourg and Portugal. Indeed, Portugal was unique among the 15 member states in that the percentages in all education levels exceeded the other countries by a factor of two to three. As many as 61% of Portuguese subjects with primary-level education did not participate in any form of physical activity and this value dropped to just 23% among those educated to tertiary level.

Conflicting statements can be observed analysing those subjects not perceiving a benefit from physical exercise and simultaneously citing to be inactive. Indeed, only 10% of these individuals (12% of female, 9% of male) recorded no physical activity. However, 24% of men and 23% of women believing themselves to be inactive, were in fact participating in some physical activity for up to 1 hour per week.

Perceived barriers

The second question aims to assess the perceived barriers which people may have to participating in physical activity. On observation of the EU average, 'work/study commitments' was the most frequently perceived barrier cited for not increasing participation in physical activity at 28%, followed by 'not the sporty type' at 25% (Table 5). The remaining perceived barriers to increase one's physical activity were not regarded as being as important. Indeed the percentage of EU subjects selecting 'looking after children/elderly relatives' and 'no need to do any more' is 12%. There were, however, significant variations between countries, particularly for the barrier 'work/study commitments' with 46% of the Italian respondents selecting this barrier in comparison to only 13% of the German respondents. Thirty-three

per cent of German subjects believed that 'not the sporty type' was a barrier in comparison to 12% of Finnish subjects. Over a quarter of Spanish subjects felt 'poor health' was a barrier to partaking in physical exercise and one-fifth of this population also believed they were too old, compared with the EU average of one in 10 subjects.

Just as there was considerable interstate variation in the perceived barriers to increasing participation level in physical exercise, there were also marked differences in percentages across demographics (Table 6). Respondents who were younger, educated to tertiary level and who were male, were more inclined to choose 'work/study commitments' as a major barrier to increasing levels of physical activity especially compared to primary-educated subjects (16%). 'Looking after children/elderly relatives' was an important barrier for females with more than three times as many (18%) selecting this barrier compared to males (5%). The barriers 'lack of facilities', 'no-one to do it with', 'fear of injury', 'shy/embarrassment', 'waste of time' were cited by less than 10% each.

The relationship between education level and the barrier 'not the sporty type' was further examined across the 15 EU member states (Table 7). The education-related decrease seen in the average EU sample was apparent in 10 of the member states. In the other five countries there was little effect of education level on the selection of this barrier. As education level of subjects increased from primary to tertiary level, so did the percentage of subjects mentioning the barrier 'work/study commitments' in all 15 member states (Table 7). Thus, for tertiary-educated subjects in all 15 member states, this time-related barrier represents an important obstacle to increasing their level of physical activity. In this instance the differences across education level within member states tended to be greater

Table 5 Percentage of subjects in each member state selecting different perceived barriers to increasing levels of physical activity/exercise

Country	Work/study	Not the sporty type	Looking after children/elderly	No need	Poor health	No energy	Too old	Other
Austria	32	22	16	13	13	10	11	42
Belgium	23	33	8	10	9	8	14	16
Denmark	21	15	13	13	13	11	7	19
Finland	16	12	10	6	14	19	3	30
France	31	26	9	15	9	9	5	12
Germany	13	33	10	18	10	15	10	20
Greece	44	17	15	6	13	5	9	12
Ireland	25	18	16	12	9	11	6	16
Italy	46	24	13	8	6	6	6	8
Luxembourg	26	18	22	11	9	12	13	12
Netherlands	25	21	11	9	12	13	11	12
Portugal	23	26	6	8	10	7	12	11
Spain	37	31	16	10	26	13	21	3
Sweden	17	25	10	6	10	16	6	21
UK	27	15	13	8	10	11	11	3
EU average*	28	25	12	12	11	11	10	12

* Weighted according to population size.

Table 6 Percentage of EU subjects selecting different perceived barriers to increasing levels of physical activity classified by demographics (age, sex and education level)

Perceived barriers	Age (years)			Sex		Education level		
	15–34	35–54	55+	Male	Female	Primary	Secondary	Tertiary
Work/study	38	32	11	32	25	16	30	43
Not the sporty type	22	27	27	22	28	32	23	21
Looking after children/elderly	14	14	7	5	18	11	13	10
No need	9	12	14	14	9	14	11	9
Poor health	7	10	5	11	11	17	9	7
No energy	9	11	14	9	13	14	10	10
Expense	14	9	5	8	11	6	12	11
Too old	2	4	28	10	10	19	7	4
Lack of facilities	11	9	7	9	9	9	9	9
Other	13	11	12	15	10	12	12	12

than between member states. Among those with a tertiary education, 23% of subjects in Germany and Sweden selected the barrier ‘work/study commitments’ compared to almost two-third of Italians with the same education level.

For those who mentioned the barrier ‘not the sporty type’, almost half of the respondents said they took part in no physical activity, compared to a quarter of those who did not mention this barrier. The percentage of respondents who mentioned ‘not the sporty type’ varied by current body image, with an increase from 30% of subjects with current body image figures 1–3 (low weight) to 45% of subjects with current body image figures 5–7 (overweight).

Participation in various physical activities was also looked at in terms of another perceived barrier ‘no need to do more’. Respondents who selected this barrier had higher rates of participation in gardening and walking and had lower levels of non-participation (24%), compared with those who did not select ‘no need to do more’ (32%). This 24% of EU subjects

represents a resistant group of inactive people who feel they do not need to be more active and presents those developing programmes which encourage increased levels of activity in the population with a formidable challenge.

Discussion

This study was intended to find new approaches to counteract the sedentary lifestyle of the European population. The results give much new information, especially for special risk groups. They demonstrate that most European individuals are quite well-informed about lifestyle factors influencing health in a positive or negative way. No information could be obtained, however, to what degree the subjects responded to the questions in a socially desired way.

Classifying the subjects of the EU member states into demographic subgroups reveals that the positive value of physical activity for health is recognized more strongly with an increasing educational level. Detailed

Table 7 Percentage of subjects in each member state who selected the barrier ‘not the sporty type’ or ‘work/study commitments’ classified by education level

Country	Not the sporty type			Work/study commitments		
	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
Austria	27	23	15	20	32	48
Belgium	38	34	25	7	21	34
Denmark	16	14	7	16	32	37
Finland	13	12	15	7	19	27
France	37	25	21	16	28	47
Germany	37	29	27	6	18	23
Greece	17	16	17	32	48	52
Ireland	17	18	20	9	25	44
Italy	31	23	20	21	48	64
Luxembourg	21	19	12	17	25	42
Netherlands	13	23	19	9	24	38
Portugal	29	20	19	17	30	45
Spain	34	26	27	33	43	51
Sweden	29	22	26	10	19	23
UK	14	15	15	12	23	43
EU average*	32	23	21	16	30	43

* Weighted according to population size.

knowledge about the benefit of physical activity in prevention and therapy of cardiovascular diseases are not common in the whole population, but more obvious in patients who are at risk or already suffer from one. This lack of specific information may cause not only a lack of motivation to increase the individual level of exercise, but also a lack in translating health-oriented knowledge into health-oriented behaviour. Thus, there is only a limited or absence of stimulation to alter the personal lifestyle on a long-term scale. Only subgroups with elevated risk show a higher affinity to draw personal consequences from their situation and to change their everyday habits. This can be demonstrated among obese and overweight females. These subjects are more likely to perceive a benefit for weight control from their physical exercise than the rest of the population. However, the ability of subjects to estimate their personal level of activity is limited to a certain degree. One reason is that the term 'physical activity/exercise' used in this study was defined in a rather broad sense. The study participants were forced to associate with the term not only sport exercise, but also all their everyday activities at work and during leisure time. Even with this information participants tended to underestimate the extent and duration of activities not typically associated with the image of physical exercise. Analogous to the phenomena of over- and under-reporting in dietary records, a similar behaviour is likely to be found in records of physical activity. As a methodical consequence it seems to be better to supply close-ended questionnaires on levels of activity to participants, so they can better control their own answers. The quality of recording may also be improved by a detailed list of several activities and by some explanations how these activities have to be recorded in respect to their duration and intensity^{12,15,24}.

From the study results it is obvious that the majority of respondents associate physical activity and exercise with being more a strenuous task and duty than with fun, recreation and relaxation. Mostly, physical activity is equated to sports. Therefore, many respondents mention 'not a sporty type' or 'too old' as a barrier and use this statement as an excuse not to increase their levels of activity. This is true also for many overweight and obese subjects who reject the idea of doing any sports and increasing their level of physical activity. They perceive a link between a lean body image and the level of activity. These subjects, especially older age groups, are not well enough informed about recent studies demonstrating the positive effects of moderate physical activity on health²⁵⁻³¹.

To stimulate more people to be physically active it is necessary to be aware of the determinants of physical behaviour. There are a number of models which explain physical activity behaviour, but in general these include three sets of determinants: (1) knowledge

and attitudes, (2) social influences, and (3) barriers and self-efficacy³². In a review Sabha and Achterberg³³ discussed the problems of recognition, interpretation and motivation arising in the complex of nutrition, activity and health-related behaviour. They demonstrated that outcome expectations, health belief and health value associated with health-related behaviour are not sufficient to release the necessary health-related action of an individual. The perceived barriers within the individual's consciousness can only be overcome by an improved self-efficacy and distinctive self-confidence.

To achieve a higher level of physical activity in the population, however, not only behavioural but also social aspects have to be considered. The social side of prevention has to take into account the opportunity available to people to implement altered activities into their lifestyle, the situation at work and education, the national conditions of health-promoting measures and the reputation of the desired behaviour within the society. Thus, the public health message to increase physical exercise in a population base seems to be very simple, as published in the USA: 'Every US adult should accumulate 30 minutes or more of moderate-intensity physical activity on most, preferably all, days of the week'³⁴. However, to be successful with such recommendations new preventive programmes have to focus both on personal and environmental conditions of the individual and the population.

Few studies in the EU, all of them on a national level, have looked at knowledge and attitudes towards physical activity³⁵. The Allied Dunbar National Fitness Survey conducted in 1992 in the UK is one example, and examined attitudes to physical activity as well as the motivating factors and barriers to participate in physical activity³⁶. No European study has, however, looked at the stages of change towards physical activity. One approach in the US, aimed at encouraging people to be more active, uses the stages of change model (PACE)⁷. This model describes the changes that need to take place for a more physically active lifestyle. While there are many programmes to tackle obesity in different countries in the EU most do so in the absence of knowledge of the attitudes towards physical activity and body weight. They also do so in the absence of the perceived motivating factors and barriers to physical activity and the stages of change towards physical activity.

Conclusions

Weight loss is best achieved by combining dietary intervention with increased amounts of physical activity. The most effective strategy for weight loss in either moderately obese or morbidly obese individuals appears to be a hypocaloric, low-fat diet combined

with a moderate-intensity, moderate-duration resistance or aerobic exercise training programme. Increasing amounts of physical activity or maintaining high levels of physical activity for purposes of weight control might be most important in preventing the increases in weight known to occur with ageing, from the early twenties through to the late sixties. This pan-EU survey of consumer attitudes to physical activity, body weight and health is the first study to examine the attitudes of EU consumers from all 15 member states, together with obtaining a measure of prevailing levels of activity, inactivity and self-reported body weight. Some strategy recommendations to increase levels of physical activity in the EU and to stem the continuing rise in obesity, by means of preventing further weight gain are proposed based on the data arising from this pan-EU consumer attitudinal survey. The preventive aspect of physical activity must be an area of priority for future research attempting to better understand the role of physical activity in weight regulation.

References

- Kuczmarski RJ, Flegal KM, Campbell SM, Johnson CL. Increasing prevalence of overweight among US adults. *JAMA* 1994; **272**: 205–11.
- Seidell JC. Obesity in Europe: scaling an epidemic. *Int. J. Obes.* 1995; **19**: S1–4.
- Biesalski HK, Liebermeister H, Remke H, Lehnert H. Langzeittherapie des Übergewichtes—Effiziente therapeutische Ansätze und Prognose. *Akt. Ernähr. Med.* 1992; **17**: 1–6.
- Zelasko CJ. Exercise for weight loss: what are the facts? *J. Am. Diet. Assoc.* 1995; **95**: 1415–17.
- Fairburn CG, Cooper F. New perspectives on dietary and behavioral treatments for obesity. *Int. J. Obes.* 1996; **20**: S9–13.
- Hauner D, Hauner H. *Leichter durchs Leben. Ratgeber für Übergewichtige. Strategien zum langfristigen Abnehmen.* Stuttgart: Georg Thieme Verlag, 1996.
- Calfas KJ, Long BJ, Sallins JF, Wooten W, Pratt M, Patric K. A controlled trial of physical counselling to promote the adoption of physical activity. *Prev. Med.* 1996; **25**: 225–43.
- Cowburn G, Hillsdon M, Hankey CR. Obesity management by lifestyle strategies. *Br. Med. Bull.* 1997; **53**: 389–408.
- Prentice AM. Obesity—the inevitable penalty of civilisation? *Br. Med. Bull.* 1997; **53**: 229–37.
- Gill T. Key issues in the prevention of obesity. *Br. Med. Bull.* 1997; **53**: 359–88.
- Sallis JF, Hovell MF, Hofstetter CR, *et al.* A multivariate study of determinants of vigorous exercise in a community sample. *Prev. Med.* 1989; **18**: 20–34.
- Blair SN, Kohl HW, Gordon NF, Paffenbarger RS. How much physical activity is good for health? *Ann. Rev. Public Health* 1992; **13**: 99–126.
- Wilmore JH. Increasing physical activity: alterations in body mass and composition. *Am. J. Clin. Nutr.* 1996; **63** (Suppl.): S456–60.
- Paffenbarger RS. Physical activity, physical fitness, and coronary heart disease. In: Leaf A, Weber PC, eds. *Atherosclerosis Reviews*, Vol. 21. New York: Raven Press, 1990; 35–41.
- Helmert U, Herman B, Shea S. Moderate and vigorous leisure-time physical activity and cardiovascular disease risk factors in West Germany, 1984–1991. *Int. J. Epidemiol.* 1993; **24**: 285–92.
- Mensink GBM, Deketh M, Mul MDM, *et al.* Physical activity and its association with cardiovascular risk factors and mortality. *Epidemiology* 1996; **7**: 391–7.
- Mensink GBM. *Movement and Circulation. Population Studies on Physical Activity and Cardiovascular Disease Risk.* Wageningen: Ponsen & Looijen BV, 1997.
- Lamb KL, Roberts K, Brodie DA. Self-perceived health among sports participants and non-sports participants. *Soc. Sci. Med.* 1990; **31**: 963–9.
- Fentem PH. Benefits of exercise in health and disease. *BMJ* 1994; **308**: 2–6.
- Flatt JP. McCollum Award Lecture: Diet, lifestyle and weight maintenance. *Am. J. Clin. Nutr.* 1995; **62**: 820–36.
- Quinney AH, Ganvin L, Wall TA, eds. *Toward Active Living.* Champaign, IL: Human Kinetics, 1994.
- Johnson NA, Boyle CA, Heller RF. Leisure-time physical activity and other health behaviours: are they related? *Aust. J. Public Health* 1995; **19**: 69–75.
- Kearney JM, Kearney M, McElhone S, Gibney MJ. Methods used to conduct the pan-European Union survey on consumer attitudes to physical activity, body weight and health. *Public Health Nutr.* 1999; **2**: 79–86.
- Duncan JJ, Gordon NF, Scott CB. Women walking for health and fitness. How much is enough? *JAMA* 1991; **266**: 3295–9.
- Vorrips LE, van Staveren WA, Hautvast JGAJ. Are physically active elderly women in a better nutritional condition than their sedentary peers? *Eur. J. Clin. Nutr.* 1991; **45**: 545–52.
- Vaughan L, Zurlo F, Ravussin E. Aging and energy expenditure. *Am. J. Clin. Nutr.* 1991; **53**: 821–5.
- Reaven PD, Barrett-Connor E, Edelstein S. Relation between leisure-time physical activity and blood pressure in older women. *Circulation* 1991; **83**: 559–65.
- Owens JF, Matthews KA, Wing RR, Kuller LH. Can physical activity mitigate the effects of aging in middle-aged women? *Circulation* 1992; **85**: 1265–70.
- Wagner EH, LaCroix Z. Effects of physical activity on health status in older adults. I: Observational studies. *Annu. Rev. Public Health* 1992; **13**: 451–68.
- Fielding RA. The role of progressive resistance training and nutrition in the preservation of lean body mass in the elderly. *J. Am. Coll. Nutr.* 1995; **14**: 587–94.
- Bijnen FCH, Feskens EJM, Caspersen CJ *et al.* Physical activity and cardiovascular risk factors among elderly men in Finland, Italy, and the Netherlands. *Am. J. Epidemiol.* 1996; **143**: 553–61.
- Van Mechelen W. Can running injuries be effectively prevented? *Sports Med.* 1995; **19**: 161–5.
- Sabha A, Achterberg C. Review of self-efficacy and focus of control for nutrition- and health-related behavior. *J. Am. Diet. Assoc.* 1997; **97**: 1122–32.
- Pate RR, Pratt M, Blair SN, *et al.* Physical activity and public health. A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *JAMA* 1995; **273**: 402–7.
- Cavill N. National campaigns to promote physical activity: can they make a difference? *Int. J. Obes.* 1998; **22**: S48–S51.
- Fentem PH, Mockett SJ. Physical activity and body composition: what do the national surveys reveal? *Int. J. Obes.* 1998; **22**: S8–S14.

Public Health Nutrition

Special Issues and Supplements

Public Health Nutrition will publish special issues and supplements that concentrate on a particular topic. These fulfil the dual functions of contributing to the existing knowledge and providing an overview of the subject area.

The 1999 volume will feature the following supplementary issues:

- Diet and physical activity interaction for health
- Consumer attitudes to physical activity, body-weight and health in the European Union

All supplements and special issues will be supplied to subscribers as part of their annual volume. Apply to either the Editor-in-Chief or Editor for North America for further details or to suggest topics of interest.

Dr Barrie Margetts (Editor-in-Chief)
Institute of Human Nutrition
Southampton General Hospital
Southampton
UK
Tel: +44 (0)1703 796 530
Fax: +44 (0)1703 796 529
Email: bmm@soton.ac.uk

Dr Lenore Kohlmeier (Editor for North America)
Departments of Nutrition & Epidemiology
Schools of Public Health and Medicine
Office 2105E, McGavran-Greenburg Building
University of North Carolina at Chapel Hill
NC 27599-7400
USA
Tel: +1 (919) 966 7450
Fax: +1 (919) 966 2089
Email: LenoreK@unc.edu



***Desktop access to
worldwide nutritional
science information***

Access these journals on the Internet in 1999:

- *British Journal of Nutrition*
- *Nutrition Research Reviews*
- *Proceedings of the Nutrition Society*
- *Public Health Nutrition*
- *Nutrition Abstracts and Reviews Series A: Human and Experimental*
- *Nutrition Abstracts and Reviews Series B: Livestock Feeds and Feeding*

Access to the electronic version of each journal is **FREE** to members of institutions/organizations with a current print subscription to that journal. All you have to do is register.

For more information about this unrivalled resource in nutritional science information and for details of how to register, visit Nutrition CABWeb now at:

<http://nutrition.cabweb.org>



CAB International
Wallingford
Oxon, OX10 8DE, UK
Tel: +44 (0)1491 832111
Fax: +44 (0)1491 829198
Email: publishing@cabi.org



CAB International
10 East 40th Street, Suite 3203
New York, NY 10016, USA
Tel: +1 212 481 7018
Fax: +1 212 686 7993
Email: cabi-nao@cabi.org