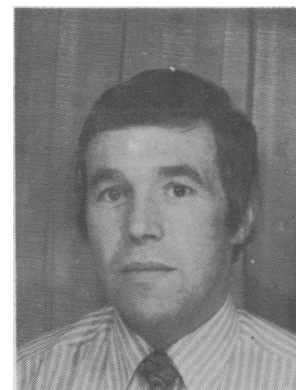


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## INCIDENCE OF TRAINING-RELATED INJURIES AMONG MARATHON RUNNERS

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### ABSTRACT

A questionnaire was sent to all 960 entrants in a major city marathon race to obtain information on training-related injuries. A total of 497 replies were received; of these 287 (58%) had incurred some form of injury during preparation for the race. Seventy-one of these individuals reported more than one injury. Almost all injuries affected the lower limb, with 113 cases (32%) involving pain or disability in the knee. More than half the injured runners (158, 55%) sought no professional advice; approximately half (146, 51%) received no treatment other than rest, which was not generally considered a form of therapy. Only 18 runners (6%) reported no improvement in their condition, while 143 individuals (51%) reported a full recovery. Injury incurred during training was thought by 98 runners (35%) to have had an adverse effect on their racing performance. These results suggest that runners preparing to compete in marathon races can expect their training to be interrupted by injury.

### INTRODUCTION

In recent years, marathon running has become one of the most popular participant sports in this country. This is in marked contrast to the former situation, when participation in this event was confined to a small number of individuals, most of whom had a long history of training for and competition in races over shorter distances. While the beneficial effect of regular exercise on cardiovascular health is undisputed, the phenomenon of mass participation in marathon races is too recent for its effect on long-term health to be assessed. It seems probable, however, that injuries affecting the tendons, ligaments and joints of the lower limbs will result from overuse, not just from participation in the event but also from the necessarily long training sessions. A recent survey by Nicholl and Williams (1982), has drawn attention to the high incidence of injury associated with participation in a popular marathon event. Little or no information is available, however, on the nature, frequency and severity of injuries associated with training for such an event. The aim of the present study,

therefore, was to obtain data regarding training-related injuries in marathon runners.

### MATERIALS AND METHODS

The Aberdeen Milk Marathon was held on Sunday, 19th September, 1982 over an accurately measured course of 26.2 miles. The race attracted 948 entries, and an additional 12 invited international athletes also competed. Of these, 760 appeared on the day and started the race; 689 runners (91%) completed the course, in times ranging from 2 hr 16 min for the winner to 5 hr 33 min for the last finisher. The weather was cool (11°C) and dry with little wind, providing favourable conditions for an event of this type. One week after the race, a questionnaire was sent to all entrants. The questionnaire was designed to elicit information regarding the training status of the competitors and the incidence and nature of injuries incurred during training and the race itself.

A total of 497 replies were received; 472 of these were from male runners and 25 from females. The average age of the respondents was  $32 \pm 8$  years (Mean  $\pm$  SD). They had been training for a period of  $31 \pm 66$  months, although considerable variability was noted: some individuals had been training for over 20 years whereas others admitted to no training whatsoever. The average weekly mileage in the 6-month period preceding

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the race was  $34 \pm 17$  and the highest weekly mileage in the same period was  $52 \pm 21$  miles. The longest single run undertaken by competitors during this period was  $19 \pm 7$  miles. Of those replying, 298 (60%) had not previously run a marathon.

## RESULTS AND DISCUSSION

The total number of runners replying to the questionnaire was 497; this represents 52% of all those who entered for the race, and 65% of the number who actually turned up on the day of the race. Analysis of the completed questionnaires revealed that 287 (58%) of those replying had incurred some form of injury in preparation for this race. The severity of these injuries can be judged from the fact that 216 (75%) of the injured competitors considered the disability sufficiently serious to allow it to interrupt their normal training programme. Although in many cases, the interruption lasted for only a few days, in 39 of the runners, running was not resumed within 4 weeks of the injury (Table I).

TABLE I

Effect of injury on training patterns.

Weeks missed	Number of runners	% of Total Replies
< 1	63	12.7
1-2	49	9.9
2-3	41	8.2
3-4	24	4.8
4-6	20	4.0
> 6	19	3.8
TOTAL	216	

Of the 287 injured individuals, 71 reported more than one injury. These data have been analysed according to the site of injury, and the results are presented in Table II. In view of the nature of marathon running, it is not surprising to observe that the majority of the injuries affected the lower limbs. From a total of 358 injuries, only 20 (6%) did not involve the leg, hip or groin. By far the most common site of injury was the knee which accounted for a total of 113 cases (32% of all injuries); most of these injuries (100 out of 113, 88%) were localised to the anterior aspect of the knee. This figure is in close agreement with results reported by James et al (1978) who presented the results of a survey of injuries present in runners seeking medical treatment; 29% of the 232 problems dealt with were associated with knee pain.

A number of runners expressed a marked reluctance to seek professional help. More than half the injured runners (158 out of 287, 55%) sought no help; of those who did, 55 (19%) visited their general practitioner, while 41 (14%) sought treatment from a physiotherapist. Twelve individuals (4%) were treated by hospital referrals, and 21 runners (7%) sought advice from

TABLE II

Prevalence of injuries incurred during training in relation to the site of injury.

Site	Number of Injuries	%
Foot	48	13
Ankle	43	12
Achilles tendon	40	11
Calf	23	6
Shin	21	6
Knee, anterior	100	28
Knee, posterior	13	4
Thigh	18	5
Hamstring	13	4
Groin	8	2
Hip	11	3
Abdomen	2	1
Chest	2	1
Shoulder	1	0
Back	12	3
Other	3	1
TOTAL	358	100

another source, usually a running companion. Approximately half of those injured (146 cases, 51%) received no treatment (Table III); interestingly, rest, other than that enforced by the severity of the injury did not appear to be widely prescribed or used as a form of treatment. Support of damaged structures by the application of strapping was the most widely used form of treatment, although among physiotherapists, ultrasound appears to be the treatment of choice.

TABLE III

Source of professional advice in relation to treatment administered. Although rest was often used as a form of treatment, it was not generally perceived in this way.

Treatment	None	GP	Hospital	Physio	Other	All
None	110	24	4	4	4	146
Strapping	17	14	4	1	5	41
Ice	3	1	0	1	1	6
Heat	5	1	1	1	1	9
Rubifacient	3	0	0	0	0	3
Massage	6	0	0	4	4	14
Medication	0	8	0	0	0	8
Rest	3	3	0	1	0	7
Ultrasound	0	2	0	21	1	24
Shoe Support	0	0	0	1	0	1
Other	1	1	3	7	5	17
All	148	54	12	41	21	276

Analysis of the site of injury in relation to the professional help sought revealed that injury to the anterior aspect of the knee was most likely to make people seek help. Of 97 cases for whom this information

is available, 47 (48%) sought advice or treatment, mainly from a general practitioner or physiotherapist.

Of those suffering from injury, only 18 (6%) reported that neither treatment nor the passage of time had resulted in any improvement in their condition. A full recovery was reported by 143 individuals (51%) representing a total of 177 injuries, while the remaining 119 runners (43%, 151 cases) had partial recovery. Table IV shows the extent of remission of symptoms in relation to the site of injury for all injuries. The persistency of these injuries is evident from the fact that 98 runners (35%) claimed that their performance in the race was adversely affected by an injury incurred during training. A total of 36 runners were prevented by injury from competing in this race, for which all had entered some months previously. The injuries most commonly responsible for this inability to compete were: anterior aspect of the knee, 11 cases; ankle, 6 cases; achilles tendon, 6 cases; shin, 6 cases.

**TABLE IV**

**Extent of recovery from injury in relation to the site of injury. This table includes data of all injuries, and refers to 287 individual runners.**

Site	Recovery			
	Full	Partial	None	All
Foot	23	23	2	48
Ankle	20	19	2	41
Achilles tendon	19	18	1	38
Calf	16	7	0	23
Shin	12	7	1	20
Knee, anterior	43	41	11	95
Knee, posterior	8	4	0	12
Thigh	11	7	0	18
Hamstring	8	5	0	13
Groin	1	4	1	11
Abdomen	1	1	0	2
Chest	1	1	0	2
Shoulder	1	0	0	1
Back	4	7	0	11
Other	3	0	0	3
All	177	151	18	346

A total of 449 runners completed the section of the questionnaire which referred to injuries incurred during the race itself; 131 of these (29%) reported that some form of injury had occurred during the race itself. This figure is in marked contrast to the number of people who actually sought first-aid treatment during the race or immediately afterwards. Although no exact record was kept, the number of casualties who contacted the first-aid personnel present at the race was extremely small, and certainly did not exceed 20. These figures compare with a casualty rate, calculated from records kept at first-aid stations, of 18% of all competitors in a

large marathon (2,289 finishers) (Nicholl and Williams, 1982). The distribution of the injuries recorded in the present study is shown in Table V. The most common problem associated with competition appeared to be injury to the foot, associated with prolonged pounding on a hard surface. Injuries to the calf muscles also appeared to be relatively more common in competition than in training. Knee injuries were again common, and occurred with about the same frequency as during training. In 36 competitors, performance was thought to have been adversely affected by the injury sustained, whereas the remainder considered that it had no effect on their running ability. Foot injuries were most likely to affect performance (23 cases).

**TABLE V**

**Analysis of the incidence of injury sustained during the race in relation to the site of injury.**

Site	Number of Injuries	%
Foot	48	37
Ankle	6	5
Achilles tendon	3	2
Calf	12	9
Shin	1	1
Knee, anterior	37	29
Knee, posterior	2	2
Thigh	7	5
Hamstring	2	2
Groin	3	2
Hip	1	1
Abdomen	1	1
Chest	1	1
Shoulder	1	1
Back	2	2
Other	2	2
TOTAL	129	100

In conclusion, it appears that injuries among runners preparing to compete in a marathon race are more common than might be supposed. Over half of those responding to the questionnaire reported some form of training-related injury. Approximately one third of these individuals felt that their performance in the race was adversely affected by injury. In spite of this, a marked reluctance to seek treatment was apparent.

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## REFERENCES

- James, S. L., Bates, B. T. and Osternig, L. R., 1978 "Injuries to runners". *Am.J.Sports Med.* 6: 50-60.
- Nicholl, J. P. and Williams, B. T., 1982 "Popular marathons: forecasting casualties". *Br.Med.J.* 285: 1464-1465.

## BOOK REVIEW

**Title:** FOCUS ON THE MARATHON  
**Authors:** J. Humphreys and R. Holman  
**Publisher:** E.P., Wakefield, 1983  
**Price:** £7.50 hard back £4.95 paperback

Marathon running is presently one of the fastest-growing participant sports in this country. Following in the wake of this expansion of interest has been a stream of publications dealing with all aspects of the subject. Many instant experts on sports medicine and physiology have appeared, and have in many cases been dispensing information which is at best misleading, and at worst dangerous. It was a relief therefore to turn to this book, written by Humphreys, a lecturer in physiology at Leeds Polytechnic, and Holman, one of the country's leading marathon coaches. "Focus on the Marathon" concentrates on the physiological aspects of training for and participating in marathon races although it does include a chapter on sports injuries (written by Ian Adams).

My pleasure on opening a book by such a reputable trio of authors was unfortunately short lived. The publisher's information reveals that the book is aimed at "athletes, coaches and aspiring runners". It is certainly not aimed at the medical profession, and offers little to commend itself to the readers of this journal. The main problem facing a book of this nature is to translate the vast amount of available information into a concise form which is intelligible to the layman, without diluting it to such an extent that errors of fact appear. This task is far more difficult than is generally recognised, and the authors have not been entirely successful in their attempt to accomplish it. While the small errors present may make little practical difference to the athlete or coach their presence is to be deplored, and awareness of them removes any enjoyment which might otherwise be gained from reading some of these chapters.

Both main authors appear to be under the impression that endurance training results in a decrease in the respiratory rate at rest, and even go so far as to suggest that this can be used as an index of the response to training. This suggestion is not supported by any published experimental data. Again, there is no evidence to substantiate the statement that trained marathon runners have a blood haemoglobin concentration greater than that of untrained individuals.

An extensive section on diet deals largely with procedures designed to increase the muscle glycogen content prior to racing. While the performance of exercise on a bicycle ergometer is undoubtedly enhanced by these procedures, marathon running may not be greatly influenced by an increase in the muscle glycogen content. There seems little point, therefore in recommending this practice to the novice runner. The impression is gained that the early work of Bergstrom and Hultman referred to running exercise. This is not the case; the experiments were invariably conducted using cycling exercise.

These few points are indicative of some of the misinformation conveyed by this book. It is a pity that some of these errors could not have been edited out as there is a great need for an elementary guide to successful marathon running, and this book does present some useful information on the design of training programmes. In the meantime, Dr. David Costill's book "A scientific approach to distance running", although now slightly dated, must be the book of choice for the interested amateur who wishes to learn something of the physiology and biochemistry of marathon running.

The chapter entitled "Sports injuries and the marathon runner" amounts to less than six pages of text. Such brevity is inconsistent with an adequate coverage of the subject, although a good attempt has been made given this restriction. Anyone reading the report on page 164 of this issue, however, will realise that I disagree with the author regarding the relative frequency of knee injuries in marathon runners.

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