Gastrointestinal Blood Loss Associated with Running a Marathon

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Gastrointestinal bleeding has been observed in long-distance runners. We prospectively studied participants of the Eighth Annual Marine Corps Marathon to determine the incidence of gastrointestinal blood loss associated with long-distance running. Of 600 runners contacted, 125 (21%) returned a questionnaire as well as pre- and postmarathon stool specimens. Stool specimens converted from Hemoccult negative to positive in 29/125 (23%) of the participants, indicating that running the marathon was associated with gastrointestinal blood loss (P < 0.001). The incidence of this conversion (negative to positive) was significant for both males (N = 68, P < 0.001) and females (N = 57, P < 0.05). Gastrointestinal bleeding appeared to be independent of age, race time, abdominal symptoms, and the recent ingestion of aspirin, vitamin C, or steak.

Long-distance running has become a popular recreational activity, with an estimated 30 million adult runners in the United States (1). Despite the excellent physical condition of runners, several nonorthopedic problems can occur. These include hyperthermia (2), rhabdomyolysis (3), acute renal failure (4), hematuria (5), proteinuria (6), and bradyarrhythmias (7, 8). Gastrointestinal symptoms associated with running include diarrhea, nausea, vomiting (9), abdominal cramps (10), heartburn (11), and gastrointestinal bleeding (10, 12).

A small group of young, elite male runners has recently been reported in which Hemoccult-positive stools were found in those with fast marathon completion times, suggesting that these particular individuals may be at risk for gastrointestinal bleeding (13). We report the results of a larger prospective study that included runners of all ages and both sexes who had a wide range of ability levels as reflected by their race completion times.

MATERIALS AND METHODS

Study Population. Six hundred participants selected at random by personnel at the Eighth Annual Marine Corps Marathon Headquarters were contacted by mail and asked to participate in the study. Equal numbers of both sexes and age groups (<35 years and ≥35 years) were contacted. This protocol was approved by the Department of Clinical Investigation of the Walter Reed Army Medical Center (WRAMC No. 1452).

Questionnaire. Data obtained with the questionnaire included age, sex, completion of the marathon (yes/no), elapsed time for the 26-mile course, and gastrointestinal symptoms. Premarathon symptoms included a history of diarrhea or hematochezia associated with running. The intramarathon symptoms included the presence or absence of abdominal cramps and vomiting. The postmarathon symptoms included the presence or absence of diarrhea or hematochezia. In addition, the participants recorded if they had ingested aspirin, vitamin C, or steak within 24 hr prior to the marathon.

TABLE 1. HEMOCCULT TEST RESULTS IN PARTICIPANTS
BEFORE AND AFTER RUNNING A MARATHON

Stool Hemoccult*			Runners			
	Total	Mean age (yrs)†	Finished	Mean time (min)†	Male	Female
−/−	82	37 ± 10	77	235 ± 38	48	34
+/+	8	35 ± 6	8	217 ± 38	3	5
+/−	6	34 ± 6	5	252 ± 26	1	5
−/+	29	35 ± 7	28	228 ± 37	16	13
P value	<0.0001	NS	<0.0001	NS	<0.001	<0.05

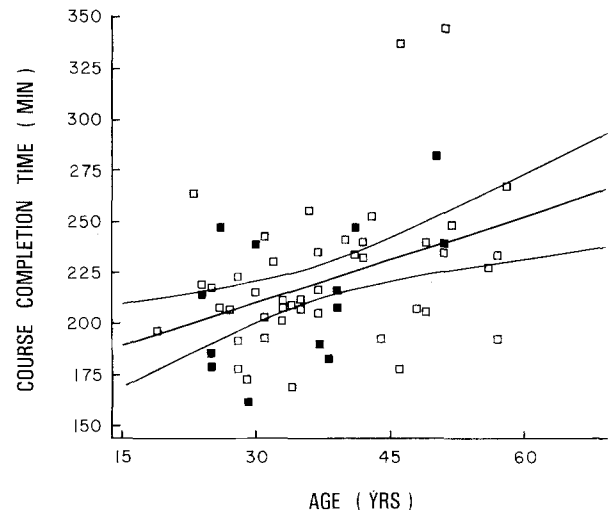*(/) denotes Hemoccult test results before and after marathon, respectively.
†± SD.

AGE (YRS)

Fig 1. Correlation of age and race time among all males whose stools were Hemoccult negative before the marathon ($N = 57$, $r = 0.364$, $P < 0.02$). □ denotes those who remained negative after the marathon, and ■ denotes those who converted from negative to positive after the marathon. Curved lines show 95% confidence limits.

Analysis for Occult Fecal Blood Loss. Six double-window Hemoccult cards (Smith Kline Diagnostics) were sent to each participant. They were asked to obtain two specimens from a stool on each of three days prior to the marathon and two specimens from each of the first three stools following the marathon. To assure maximum sensitivity of the Hemoccult cards, participants were included in the study only if the specimens were developed by us within 12 days of the first stool collection, a time limit recommended for Hemoccult cards. The cards from each participant were developed without knowledge of the sequence of their collection. Gastrointestinal blood loss, either pre- or postmarathon, was considered to have occurred if any one of the windows tested positive. Based on their pre- and postmarathon Hemoccult results (pre/post), the participants were then categorized into one of four possible groups: −/−; +/+; +/−; and −/+.

Statistical Analysis. Changes in Hemoccult test results following the marathon were examined for statistical significance by the one-tailed sign test. Differences between subgroups such as males or females, were examined for statistical significance by chi-square analysis. The elapsed race times of different subgroups were compared using an analysis of variance. The correlation between age and race time was examined by regression analysis. Where applicable, data are reported as the mean value ± one standard deviation. In our study, any $P < 0.05$ was considered statistically significant.

RESULTS

Of the 600 runners contacted, 125 (21%) returned the questionnaire and stool specimens within 12 days of the first stool specimen collection and participated in the study. Their mean age was 37 ± 9 years (males: $N = 68$, 38 ± 10 years; females: $N = 57$, 37 ± 9 years). One-hundred twenty of the participants (96%) finished the marathon, and 117 (94%) reported their race time. Most participants had Hemoccult-negative stools both before and after the marathon (−/−, $N = 82$, Table 1). Some, however, had Hemoccult-positive stools before and

after the marathon (+/+, $N = 8$). Of those participants who completed the marathon, more converted from Hemoccult negative to positive (−/+, $N = 28$) than from positive to negative (+/−, $N = 5$), indicating that running the marathon was associated with a significant increase in the incidence of gastrointestinal bleeding ($P < 0.0001$). There was no significant difference in age or race times among the participants that formed the four possible groups of Hemoccult test results (Table 1).

Age and gender did not appear to influence the incidence of gastrointestinal bleeding. A comparable proportion of male and female runners both younger than 35 and older than 35 converted their Hemoccult test from negative to positive.

Male participants with negative Hemoccult tests of their stools before the marathon had a significant direct correlation between increasing age and race completion time ($r = 0.364$, $P < 0.02$). However, despite this relationship, there appeared to be no predilection for either young fast or old slow runners to convert their stools from negative to positive after the marathon (Figure 1). The variation in race time among individuals of comparable age was striking, but there appeared to be no trend for race completion time (ie, fast or slow) at a given age range to predict stool Hemoccult test conversion (Figure 1). There was no significant relationship between age and race time in female participants.

The ingestion of aspirin, vitamin C, or steak

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before the marathon did not appear to account for the significant increased incidence of (−/+) stool Hemoccult test conversion since those without a history of ingesting these substances also had a significant increased incidence of conversion.

Abdominal cramps ($N = 21$), diarrhea ($N = 8$), and/or vomiting ($N = 1$) were noted by 27 (22%) of the participants during or following the marathon. The presence or absence of these symptoms did not appear to influence the finding that more runners converted their stools from Hemoccult negative to positive than from positive to negative.

Twenty-one participants (17%) had a previous history of hematochezia associated with running. Of these, only six (28%) had sought medical attention for this problem. Hematochezia occurred in seven participants (6%) following the marathon. When participants with a history of hematochezia before or after the marathon were excluded, there was still a significantly increased incidence of (−/+) stool Hemoccult test conversions associated with running the marathon.

DISCUSSION

It is apparent that some degree of gastrointestinal bleeding is associated with long-distance running. Case reports (10, 12), as well as two prospective studies (13, 14), have shown that individuals preparing for a marathon, participating in a marathon, or running races of varying lengths (10–42 km) have noted either hematochezia or qualitative or quantitative evidence of blood in the stool. In fact, the incidence of Hemoccult-positive stool specimens following a marathon appears to be approximately 20% (6/32) (13). This incidence might actually be an underestimate of the true incidence since Hemoccult testing has been shown to be an insensitive indicator of fecal blood loss (15, 16).

Our data confirm that approximately 20% of runners have Hemoccult-positive stools following a marathon. In addition, we showed for the first time that there was a statistically significant conversion rate of the stool from Hemoccult negative before the race to Hemoccult positive following the race. In fact, this conversion was statistically significant in runners of both sexes and did not appear to be influenced by age, running ability, or ingestion of aspirin, vitamin C, or steak.

While gastrointestinal blood loss can be clearly attributed to running a marathon, its etiology or pathophysiologic mechanism is not readily appar-

ent. It is tempting to attribute the gastrointestinal blood loss to bowel ischemia, especially since strenuous exercise reduces abdominal visceral blood flow to 30% or less of its resting value (17–20). McMahon et al (13) suggested an ischemic etiology for the blood loss when they showed that the six runners who developed Hemoccult-positive stools after a marathon were significantly younger and had faster race times than those without Hemoccult-positive stools. Our data, however, did not confirm this observation, since we found no disproportionate clustering of runners who converted from Hemoccult negative to positive in the subgroup of young fast runners or the faster runners in any age group. Moreover, we found no reports of ischemic gastrointestinal complications such as bowel infarction or colitis associated with running. While not excluded, exercise-induced gastrointestinal ischemia does not appear to be the sole cause of the bleeding.

Mechanical trauma to the bowel incurred while running and caused by jarring of the intestine could explain the gastrointestinal blood loss. For instance, a runner has been reported who experienced abdominal cramps, right lower quadrant pain, and bloody diarrhea while preparing for a marathon (10). He had an elevated white blood cell count and appendicitis was suspected. At surgery, no appendicitis was found, but instead, the bowel appeared pale and edematous with several serosal bleeding points in the cecum and ascending colon, suggesting a possible traumatic etiology.

Precedence exists for running-associated mechanical trauma to hollow organs. For instance, traumatic urinary tract bleeding emanating from the bladder, urethra (6), and internal meatus have been observed in runners. In fact, gross areas of ecchymosis have been seen at cystoscopy (21). If traumatic bowel injury were the sole cause of the bleeding, one might anticipate that runners at risk would be older and slower, thereby affording more time for a jarring motion to cause the injury. Our data, however, did not show a disproportionate clustering of stool Hemoccult test conversions (−/+) in either older slower runners or in the slower runners in any age group. Thus, while plausible, mechanical trauma is not supported by our data as a sole cause of the bleeding.

It is conceivable that perianal disease such as hemorrhoids, fissures, or perianal chafing could lead to blood loss. While we did not examine our study participants before or after the marathon, we

did obtain historical information such as the presence or absence of hematochezia in an attempt to exclude perianal disease. When participants with hematochezia were excluded, the remaining participants still had an increased incidence of gastrointestinal blood loss. Since most participants' stools before the marathon were Hemoccult negative, preexisting bowel disease such as carcinoma, angiodysplasia, polyposis, or inflammatory bowel disease accounting for the blood loss also seems unlikely.

It is interesting to note that while almost one fifth of our participants had a history of hematochezia noted prior to the marathon, only 25% had sought medical attention. This suggests that they felt confident in attributing the bleeding to running. Despite the runner's apparent lack of concern, physicians will still be asked to evaluate this problem. This is likely, especially since 6% of the runners in our study had hematochezia following the marathon and approximately 20% had Hemoccult-positive stools. We feel that while one can legitimately attribute gastrointestinal bleeding to long-distance running, as we and others have shown, those individuals who seek medical attention should be evaluated for traditional causes in a manner similar to their nonrunning peers. This practice seems prudent until the cause of the bleeding can be found.

In conclusion, participating in a marathon results in gastrointestinal bleeding in almost one fourth of the participants manifesting as either hematochezia of Hemoccult-positive stools. This bleeding occurs in runners of both sexes over a wide age range and ability level. While this degree of bleeding is not apparently life-threatening, the cause(s) still needs to be pursued, given the popularity of long-distance running and the broad range of potentially affected individuals.

ACKNOWLEDGMENTS

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