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SCUBA DIVING AND THE MENSTRUAL CYCLE: INTERIM DATA FROM THE SECOND YEAR OF A FOUR YEAR PROSPECTIVE STUDY OF DIVING WOMEN

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Key Words

Physiology, recreational diving, women.

Background

The majority of medical recommendations concerning females in recreational scuba diving are based on data from fit young men and animals and not from females who may be menstruating, menopausal or pregnant. The effects of increased pressure, resulting from scuba diving, on the menstrual cycle, or the effect of the menstrual cycle on a woman's ability to dive safely are not well documented.

Aerospace studies have attempted to evaluate any relationship between the menstrual cycle and altitude decompression illness (DCI).^{1,2}

Studies of changes in the menstrual cycle in airline stewardesses have been carried out and have shown changes in menstruation, though some of these effects may be attributed to time zone changes.^{3,4} In addition, separate studies of Chinese and South American non-diving female populations, living at various altitudes, have demonstrated changes.^{5,6} Differences in abdominal pain, length of menstrual phase and hormone profiles were observed.

Only one formal preliminary study has so far attempted to address the issue of whether scuba diving affects the menstrual cycle.⁷ This study acknowledged that more precise information and more subjects were necessary to expand on the results which showed that the dives, carried out in the hyperbaric chamber on two women, had no gross effect on the menstrual cycle.

Recently Doyle found that data from the Divers Alert Network (DAN) data base showed women taking the oral contraceptive pill were more likely to experience DCI if they dived whilst menstruating.⁸

Comparative studies, between males and females,⁹⁻¹² have attempted to assess the relative risk of diving DCI. The most recent is the "Men and Women in Diving" (MWD) study carried out by the Diving Diseases Research Centre (DDRC).¹³ Studies have differed in their findings. Zwingelburg and later both Fife studies found no difference between males and females in the incidence of DCI. Bangasser's study showed that there was a 3.3 fold increase in the incidence of DCI amongst women compared

with males in the study. The MWD study showed, that when other factors such as number of dives and years of experience were taken into account, males had a higher rate of incidents of DCI than females per thousand dives.

In addition to the current "Scuba Diving and the Menstrual Cycle" project, the DDRC is collaborating with the Defence Research Evaluation Agency (DERA) gathering data in which the incidence of DCI in female divers is being observed in relationship to the phase in the menstrual cycle. This paper presents preliminary data from that study.

Methods

As a result of the findings and comments of the Men and Women in Diving study, the present prospective study was launched in May 1996 and was designed solely to expand on our knowledge of women, diving, contraception and the menstrual cycle.

The study uses a combination of questionnaires and charts. Initially, each respondent is required to fill in a preliminary comprehensive background questionnaire covering personal details, diving history, any previous DCI incidents, medical and reproductive history, and any effects they have experienced whilst diving.

The dive/menstrual cycle charts are designed to record the cycle, type of bleeding, depth/diving profiles and any *diving* incident experienced. The women record the required information on the charts for the next three consecutive years, returning the charts on a six monthly basis. A time period of three years was chosen in an attempt to gain a reasonable overview of each woman's diving career and menstrual history. An interim questionnaire, which records any changes in the woman's health, personal status and diving status is also returned with the charts. Respondents then continue with the next six month's record keeping. The first group of women commenced in November 1996 and completed the first year of record keeping in November 1997, they will finish the project in November 1999. The fourth group of women commenced in January 1998 and will complete in January 2001. Women who are not menstruating, for whatever reason, have also been encouraged to take part in order that the rate of diving incidences in the women who *are* menstruating may be compared with women who are *not*.

A data base has been developed to enable all dive profiles, menstrual histories and diving incidents to be evaluated and compared.

The logistics of managing and tracking a large number of women with the resources of a small research team on a very limited budget are considerable, but every attempt is being made to encourage the women to complete

the project. In the last eighteen months 12% of women have changed addresses, and of that group, 8% have moved more than twice, confirming the need to keep in constant touch with the respondents.

Results

Data from the DDRC *retrospective* MWD study indicated some women *perceived* there was an effect of diving on the menstrual cycle, challenging previous diving studies.

Women who dived whilst menstruating reported the following *perceived* problems of tiredness, cold, rapid temperature drop, slower reactions, impaired reactions and decreased confidence. There were also reports of light headedness and dizziness, feelings of panic, a general feeling of loss of control and feeling physically weaker. Some reported a *perceived* tendency to be more susceptible to nitrogen narcosis.

The women also reported that diving whilst experiencing period pains actually reduced their pain quite noticeably. Other signs reported were the early onset of menstruation, increased bleeding both during and after a dive, and spotting during consecutive day diving.

Still from the MWD study, 76% of the women who reported using a diaphragm or cap had dived with it in place. There were reports of it becoming impacted and difficult to retrieve. Useful advice was given concerning the removal of the impacted item by the women who responded, but highlighted the need for diving physicians to offer women advice on diving when using a diaphragm or cap to ensure that pelvic infection does not result from such an occurrence and that they are aware of the trauma caused by impaction and a diaphragm or cap's unconventional removal.

Also in the retrospective study 34% of all the respondents either regularly or sometimes suffered impaired reactions; 71% of all the respondents regularly or sometimes reported suffering from pre-menstrual tension.

From the current prospective study, to date a total of 956 women, collectively recording 199,861 dives, and with an age range of 14 -69 (mean of 35) have so far reported an average diving experience of 4.75 years each. 114 of the women are over the age of 45 years.

Tables 1 and 2 show the distribution of the menstrual state and the methods of contraception used from a sample of 620 women who have returned the appropriate data in the last eighteen months.

Increasingly, women are inquiring about the relationship between hormone replacement therapies (HRT) and scuba diving, therefore the study is also gathering data

TABLE 1

**DISTRIBUTION OF WOMEN MENSTRUATING
AND NOT MENSTRUATING**

	Total	%
Menstruating	511	83%
Hysterectomy	32	5%
Peri or post menopausal	77	12%
Total	620	100%

concerning HRT and the methods of delivery used by the respondents.

From the sample of 620 women, those who have had a hysterectomy or are peri- or post-menopausal, 30% have so far reported using HRT, oral use being the most popular method. Few women use HRT implants or patches, however one respondent with an implant has questioned how the effects of pressure could alter the delivery system.

Preliminary data from the background questionnaires show that 48% of women so far *perceive* an effect of diving on the menstrual cycle or that they *perceive* the menstrual cycle affects their ability to dive safely. Fifteen percent of women said they felt exercise affected their menstrual cycle in some way. When asked if they considered diving affected the heaviness of their period 18% said yes. The data received back from the dive/menstrual cycle charts will enable the frequency and heaviness of the bleeding to be evaluated against the dive profiles and the frequency of dives made. Twenty percent have reported an effect on the pain they experienced when diving while menstruating. Eighteen percent perceived the menstrual cycle affected their ability to dive safely and reported feelings of panic or loss of control, with anxiety being the most commonly observed. Some respondents did not feel that the menstrual cycle affected their ability to dive safely even though they had experienced feelings of panic or anxiety on occasions. Some respondents reported more than one effect. Again, the design of the charts will enable any relationship between the frequency of diving accident and the phase in the menstrual cycle to be observed. These data will be compared with the women who are not menstruating. As in the MWD study, number of dives and years of diving experience of the women will be taken into account when analysing these data.

Discussion

Preliminary results of the *prospective* study support the *retrospective* study and suggest some women *perceive* their ability to dive safely during the menstrual cycle may be impaired, and that scuba diving may alter the menstrual cycle in some women. The *prospective* data gathered from three consecutive years of diving and menstrual histories

TABLE 2

**METHODS OF CONTRACEPTION REPORTED BY
511 WOMEN**

Methods of contraception	
Oral contraceptive pill and injectable contraceptive	38%
Condom	24%
Sterilised male partners	11%
Female sterilisation	9%
Natural methods	9%
Intrauterine device	5%
Diaphragm/cap	3%
None	20%

from recreational scuba diving women, will be analysed in an attempt to qualify and quantify these perceived problems. With the *retrospective* study data there was no way to quantify changes in diving risks due to menstruation, or changes in menstruation due to diving. This was due to lack of a suitable control group. With the *prospective* data it will be possible to study these changes objectively using statistical methods of survival analysis and relative risk models. Many of the problems of identifying closely matched control groups and the problems associated with selection bias will be avoided. Estimates of the prevalence of diving diseases will be feasible. Estimates of the relative risks of diving diseases due to the menstrual cycle should also be possible. Although it is acknowledged that there will be a proportion of women who will not complete the three years commitment to the project, it is anticipated these data will provide a greater knowledge base concerning the effects of scuba diving on the menstrual cycle and the effect of the menstrual cycle on a woman's ability to dive safely.

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The team as a whole were the recipients of the 1994 "Duke of Edinburgh's Prize for the British Sub Aqua Club" for their work on the first project, Men and Women in Diving.

The 117 page publication of the results of the first project, MEN & WOMEN IN DIVING, is available from the DDRC.

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