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The effect of combined oral contraceptives and age on dysmenorrhoea: an epidemiological study

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BACKGROUND: Combined oral contraceptives (COCs) are widely advocated as treatment for primary dysmenorrhoea, but their efficacy has been questioned in a Cochrane review. The aim of this study was to evaluate COCs and the influence of age on the severity of dysmenorrhoea.

METHODS: Postal questionnaires regarding weight/height, contraception, pregnancy history and other reproductive health factors were sent to random samples of 19-year-old women born in 1962 ($n = 656$), 1972 ($n = 780$) and 1982 ($n = 666$) resident in the city of Gothenburg in 1981, 1991 and 2001. The responders were assessed again 5 years later at the age of 24 years. Current severity of dysmenorrhoea was measured on each occasion by a verbal multidimensional scoring system (VMS) and by a visual analogue scale (VAS).

RESULTS: The severity of dysmenorrhoea was lower ($P < 0.0001$) in COC users compared with non-users. In a longitudinal analysis of the severity of dysmenorrhoea, COC use and increasing age, independently of each other, were associated with the severity of dysmenorrhoea (COC use, VMS score: a reduction of 0.3 units/VAS: a reduction of 9 mm, both $P < 0.0001$; increasing age, VMS score: a reduction of 0.1 units per 5 years, $P < 0.0001$/VAS: a reduction of 5 mm per 5 years, $P < 0.0001$). Childbirth also reduced the severity of dysmenorrhoea (VAS, $P < 0.01$ with a reduction of 7 mm). Women from the 82-cohort reported a greater severity of dysmenorrhoea compared with the 62 and 72 cohorts at both 19 and 24 years of age.

CONCLUSIONS: In this longitudinal case–control study, COC use and increasing age, independent of each other, reduced the severity of dysmenorrhoea. COC use reduced the severity of dysmenorrhoea more than increasing age and childbirth. There was a trend over time regarding the severity of dysmenorrhoea where women from the 82-cohort reported a greater severity of dysmenorrhoea compared with the 62 and 72 cohorts.

Key words: dysmenorrhoea / combined oral contraception / age / epidemiology / longitudinal study

Introduction

Dysmenorrhoea is a frequently occurring condition affecting a large proportion of young women. The highest prevalence has been reported in adolescent women, where as many as 50–75% suffer from dysmenorrhoea (Andersch and Milsom, 1982a; Robinson *et al.*, 1992; Harlow and Park, 1996; Campell and McGrath, 1997; Davis and Westhoff, 2001; Harlow and Campell, 2004). About 15% of adolescent and young women describe their dysmenorrhoea as severe, causing regular absenteeism from school and work (Sundell *et al.*, 1990; Harlow and Ephross, 1995; Burnett *et al.*, 2005; Dawood, 2006). This monthly disability, which interferes with daily work several days each cycle, has been estimated to account for 600 million lost working hours and two billion dollars in lost productivity annually in the USA (Coco, 1999). Effective management of dysmenorrhoea is beneficial for both the afflicted individual and society.

Combined oral contraceptive pills (COC) have been reported to relieve dysmenorrhoea (Hendrix and Alexander, 2002; Winkler *et al.*, 2004; Davis *et al.*, 2005). The study by Davis *et al.* (2005) specifically addressed the issue of dysmenorrhoea in adolescents using a randomized placebo-controlled design and showed a positive effect on dysmenorrhoea. The efficacy of COCs and other forms of treatment for dysmenorrhoea has been analysed in two systematic reviews (Proctor and Farquhar, 2007; Wong *et al.*, 2009). A Cochrane

review (Wong et al., 2009) included 10 studies: six compared COCs with placebo and four compared different dosages of COCs. The Cochrane review (Wong et al., 2009) concluded that there was limited evidence for pain improvement and they found no difference between different COC preparations but the results were limited because of the variable quality of the randomized controlled trials included in the analysis.

In 1981, a prospective longitudinal study (Andersch and Milsom, 1982a,b) was initiated regarding contraceptive use, pregnancies and reproductive health in a random sample of 19-year-old women resident in the city of Gothenburg. The women have been followed prospectively and new cohorts of 19-year-old women were recruited in 1991 and 2001. The same women were re-assessed 5 years later at 24 years of age. The aim of this study was to evaluate COC's and the influence of age on the severity of dysmenorrhoea in this population of young women.

Materials and Methods

Study population

The women initially included were born in 1962 (Andersch and Milsom, 1982a,b) and were 19 years of age. This age was chosen in order to be able to deal with women of legal age, enabling information to be collected via the individuals themselves without the necessity of consent from their parents. Two later cohorts of 19-year-old women (born 1972, and 1982) resident in the city of Gothenburg in 1991 and 2001, respectively were also invited to participate. The study was approved by the Ethics Committee, Faculty of Medicine, University of Gothenburg, and the National Data Inspection Board approved the study design and informed consent was obtained from each participant.

There were 2621 women aged 19 years living in the city of Gothenburg in 1981 and a random sample of every fourth woman was obtained ($n = 656$) from the population register. The women from the 1962 birth cohort are referred to in the text as the '62-cohort'. Ten years later, in 1991 a one in three sample of the 2342 women aged 19 years ($n = 780$) resident in the city of Gothenburg was obtained from the population register and in 2001 (Lindh et al., 2009) a similar one in three sample of the 1998 women aged 19 years ($n = 666$) resident in the city of Gothenburg in 2001 was obtained from the population register. The 19-year-old women from the 1972 and 1982 birth cohorts are referred to as the '72-cohort' and '82'-cohort. The women were contacted by letter and requested to complete and return an enclosed questionnaire. If no reply was received, reminders were sent out after 2 and 4 weeks. Women who returned the questionnaire in 1981, 1991 and 2001 at the age of 19 years of age were contacted again 5 years later at the age of 24 years (1986, 1996 and 2006) and requested to answer and return a similar questionnaire.

The questionnaire

The questionnaire contained approximately 40 questions concerning contraception, reproductive history, menstrual pattern, duration and severity of menstrual pain, need for medical attention, ability to work during menstruation and factors such as height, weight and smoking. The severity of dysmenorrhoea was assessed by a verbal multidimensional scoring system (VMS) described previously (Andersch and Milsom, 1982a) and by a visual analogue scale (VAS) (Melzack and Katz, 1994). The VMS grades pain as none, mild, moderate or severe, and takes also into account the effect on daily activity, systemic symptoms and whether analgesics are required (Table I). VAS is a technique where a 10 cm line on a paper represents the continuum of the woman's opinion of the degree of pain (It was explained that one extremity of the line represented 'no pain at all' and the other extremity 'unbearable pain'). The ability to understand the questionnaire and reliability was evaluated in a sub-sample of 30 women and were found to be satisfactory. Reliability was tested by letting 30 women answer the questionnaire twice within a 3-week interval, and the agreement of the answers to five specific questions was tested. Ten questions in the inquiry were then selected, and the same 30 women were interviewed to see whether they understood the meaning of the questions.

Table I The VMS for assessment of severity of dysmenorrhoea (Andersch and Milsom, 1982a).

Grade	Working ability	Systemic symptoms	Analgesica
Grade 0: Menstruation is not painful and daily activity is unaffected	Unaffected	None	Not required
Grade 1: Menstruation is painful but seldom inhibits the woman's normal activity. Analgesics are seldom required. Mild pain	Rarely affected	None	Rarely required
Grade 2: Daily activity affected. Analgesics required and give relief so that absence from work or school is unusual. Moderate pain	Moderately affected	Few	Required
Grade 3: Activity clearly inhibited. Poor effect of analgesics. Vegetative symptoms, e.g. headache, tiredness, nausea, vomiting and diarrhoea. Severe pain	Clearly inhibited	Apparent	Poor effect

Characteristics of the samples and analysis of the non-responders

The questionnaire was completed and returned by 594 (91%) of the 656 women from the 62 cohort, by 641 (82%) of the 780 women in the 72 cohort and by 514 (77%) of the 666 women in the 82 cohort. The population register contains information regarding civil status, nationality and home address linked to the individual's personal identification number. The socio-economic status of the district (SES) where the woman was resident was classified according to a 3-point socio-economic index (low, medium and high socio-economic status) based on the mean level of education, income and profession/social group for all the inhabitants resident in each district (Statistics Sweden, 2001). There was no significant difference in marital status, nationality or SES of the area where the women were resident between responders and non-responders in any of the three cohorts with one exception: there was a greater ($P < 0.01$) number of non-Swedish nationals among non-responders (14%) compared with responders (6%) in the 82 cohort.

The questionnaire was completed and returned at both 19 and 24 years of age by 489 (75%) of the women born in 1962, by 523 (67%) of the women born in 1972 and by 392 (59%) of the women born in 1982. There were no significant difference regarding smoking, pregnancies, live births, contraceptive use, weight and SES of the area where the woman was resident between the responders at both 19 and 24 years of age and non-responders at 24 years of age in the three cohorts.

Data analysis and statistical methods

Data description of groups includes n = sample size, mean, standard deviation and 95% confidence limits. Group differences were tested with an ordinary two sample t-test, which throughout was confirmed with the Wilcoxon rank sum test. Individual changes within groups over time were tested with a matched paired t-test. Analysis of variance was used to investigate the influence of various factors on dysmenorrhoea and a nested design was performed to assess the interaction between the factor cohort and the predictors. To further establish possible differences between cohorts, *post hoc* tests of multiple comparisons due to Tukey were performed. A Pearson correlation test was used to compare the subjective measurement with the VMS and the VAS. Analyses were done using SAS 9.1 software (SAS Institute Inc., Cary, NC, USA).

Results

A comparison of basic characteristics between the three cohorts of women assessed at 19 and 24 years of age is shown in Table II. There was a successive increase in bodyweight between the three cohorts and the frequency of smoking decreased ($P < 0.001$) over time. The proportion of women using COCs was lower ($P < 0.001$) at the age of 24 in the 82 cohort compared with the 62 and 72 cohorts. The type of oral contraceptive used at 19 and 24 years of age varied between cohorts (Table III). In the 82 cohort, there were a greater number of women using a progestogen-only method, and COC use was lower in this cohort at the age of 24 years (Table III). The 62 cohort reported no use at all of progestogen-only methods, and in the 72 cohort, there were no use of progestogen-only methods at the age of 19 years but at 24 years of age 5% of the women used these methods. In the −82 cohort 7% reported use of these methods at the age of 19 years and 14% at 24 years of age.

The severity of dysmenorrhoea

A correlation analysis was performed to compare VMS and VAS in all women who completed the VMS and VAS ($n = 2642$) at both assessment points. There was a significant correlation ($r = 0.83$, $P < 0.0001$) between the assessment of the severity of dysmenorrhoea by the two methods. The results of the VMS are therefore presented as mean values.

A comparison of menstrual bleeding pattern and the severity of dysmenorrhoea were made both within and between the three cohorts at the ages of 19 and 24 years (Table IV). Fewer women in the 82 cohort reported no dysmenorrhoea at all according to the VMS system. Women in the 82 cohort had at 19 and 24 years a higher VMS score ($P < 0.05$; $P < 0.001$) compared with the −62 cohort and at the age of 24 years a higher VMS score compared with the 72 cohort ($P < 0.01$). Similarly, there was a greater severity of dysmenorrhoea as assessed by the VAS in the 82 cohort compared with the 62 cohort ($P < 0.001$) and the 72 cohort ($P < 0.01$) at 19 and 24 years old, respectively. Absenteeism due to dysmenorrhoea

Table II Comparison of basic characteristics (mean/%) in the same women at 19 and 24 years of age from the cohorts born in 1962 ($n = 489$), 1972 ($n = 523$) and 1982 ($n = 392$).

	Cohort 1962		Cohort 1972		Cohort 1982	
	19 years	24 years	19 years	24 years	19 years	24 years
Height, cm, mean, (95% CI)	167.1 (166.6–167.6)	167.3 (166.8–167.8)	167.2 (166.7–167.7)	167.4 (166.8–167.9)	167.3 (166.7–167.9)	167.4 (166.8–168.0)
Weight, kg, mean, (95% CI)	58.2 (57.6–58.9)	59.7 (59.0–60.5)	59.6 (58.7–60.4)	62.6 (61.6–63.5)	61.5 (60.6–62.5)	62.8 (61.9–63.8)
BMI, mean, (95% CI)	20.8 (20.6–21.0)	21.3 (21.1–21.5)	21.2 (21.0–21.5)	22.3 (22.0–22.6)	21.9 (21.7–22.2)	22.4 (22.1–22.7)
Menarche age year, mean, (95% CI)	12.9 (12.8–13.0)		12.9 (12.8–13.0)		12.8 (12.7–13.0)	
Smoker, %, (95% CI)	41 (36–45)	43 (38–47)	33 (29–38)	30 (26–34)	27 (22–31)	17 (13–21)
Number of pregnancies, mean, (95% CI)	0.19 (0.15–0.24)	0.80 (0.69–0.91)	0.15 (0.10–0.19)	0.65 (0.56–0.74)	0.16 (0.10–0.21)	0.43 (0.35–0.52)
Number of children, mean, (95% CI)	0.06 (0.03–0.08)	0.38 (0.31–0.44)	0.02 (0.01–0.04)	0.34 (0.27–0.41)	0.02 (0.00–0.04)	0.12 (0.08–0.15)
COC use, %, (95% CI)	46 (42–51)	51 (47–56)	46 (42–51)	49 (44–53)	46 (41–51)	34 (30–39)

COC, combined oral contraceptive.

Table III Comparison of the type of COC used at 19 and 24 years of age in the three cohorts of women born in 1962 (n = 489), 1972 (n = 523) and 1982 (n = 392).

COC type	Cohort 1962		Cohort 1972		Cohort 1982	
	19 years	24 years	19 years	24 years	19 years	24 years
All COC users, *n*	225	249	244	254	183	135
COC with 50 μg EE	46 (20%)	26 (10%)	5 (2%)	1 (0.4%)	0 (0%)	0 (0%)
COC with 30 μg EE + 150 μg LNG	157 (70%)	85 (34%)	7 (3%)	15 (6%)	15 (8%)	23 (17%)
Triphasic COC	0 (0%)	104 (42%)	90 (37%)	112 (44%)	83 (45%)	44 (33%)
Other COCs	4 (2%)	11 (4%)	123 (50%)	100 (39%)	68 (37%)	56 (42%)
Name unknown	18 (8%)	23 (9%)	19 (8%)	26 (10%)	17 (9%)	12 (9%)

Data are *n* (% of all COC users).
EE, ethinyl estradiol; LNG, levonorgestrel.
Other COCs = 30 μg or 20 μg ethinyl estradiol in combination with desorgestrel/drospirenone etc.

Table IV Comparison of menstrual bleeding pattern and severity of dysmenorrhoea in the same women at 19 and 24 years of age from the cohorts born in 1962 (n = 489), 1972 (n = 523) and 1982 (n = 392).

	Cohort 1962		Cohort 1972		Cohort 1982	
	19 years	24 years	19 years	24 years	19 years	24 years
Menstrual cycle						
Length of cycle, days, (95% CI)	28.0 (27.6–28.3)	27.2 (26.8–27.5)	28.1 (27.7–28.6)	27.7 (27.2–28.2)	27.2 (26.5–28.0)	27.0 (26.3–27.6)
Duration of menses, days, (95% CI)	5.3 (5.2–5.4)	5.2 (5.1–5.3)	5.4 (5.2–5.5)	5.2 (5.0–5.3)	5.3 (5.1–5.4)	5.2 (5.1–5.4)
Dysmenorrhoea						
VAS, mean, (95% CI)	41.2 (38.3–44.0)	34.2 (31.7–36.6)	42.9 (40.1–45.7)	38.7 (36–41.2)	49.6 (46.8–52.5)	45.1 (42.2–48.0)
VMS *n* (%)						
0	134 (27.9)	157 (33.0)	137 (27.2)	137 (28.3)	64 (16.5)	72 (18.9)
1	170 (35.3)	167 (35.1)	156 (31.0)	173 (35.7)	142 (36.7)	153 (40.1)
2	109 (22.7)	106 (22.3)	142 (28.2)	147 (30.4)	137 (35.4)	121 (31.7)
3	68 (14.1)	46 (9.7)	69 (13.7)	27 (5.6)	44 (11.4)	36 (9.4)
VMS, mean, (95% CI)	1.23 (1.14–1.32)	1.1 (1.0–1.17)	1.28 (1.20–1.37)	1.13 (1.05–1.21)	1.42 (1.33–1.51)	1.32 (1.23–1.41)
Absenteeism due to dysmenorrhoea, %, (95% CI)	32 (28–36)	21 (18–25)	33 (29–37)	20 (16–23)	31 (27–36)	23 (19–28)
Analgesic required, %, (95% CI)	26 (22–30)	22 (18–25)	32 (28–36)	30 (26–34)	29 (25–34)	28 (24–33)

VAS, visual analogue scale, VMS, verbal multidimensional scoring system.

was reported between 31 and 33% at the age of 19 years and decreased in all three cohorts at the age of 24 years (20–23%).

The use of COC and dysmenorrhoea

The severity and changes in severity of dysmenorrhoea were assessed using both the VMS and VAS in a longitudinal, individual analysis of the same women in the three cohorts at 19 and 24 years of age grouped according to the use or non-use of COC (Table V). The women were assessed in two separate groups using a case control model; one group where the women were using COC at 19 years of age and no COC at 24 years of age; and the second group consisted of women who used no COC at 19 years of age and who then used a COC at 24 years of age. These two separate groups were then compared with each other to investigate possible differences in severity of dysmenorrhoea when using COC. Parous women and women using an intrauterine device (IUD) or progestogen-only methods were excluded from these analyses.

When considering all three cohorts together, the women who were using COC at the age of 19 years and had no use of COC at the age of 24 years reported increased severity of dysmenorrhoea, while women with no use of COC at 19 years reported a decrease in the severity of dysmenorrhoea when using COC at the age of 24 (Table V). The total benefit associated with COC use on the severity of dysmenorrhoea between groups was equally apparent when using both the VMS system [$P < 0.0001$, 0.58: confidence interval (CI): 0.35–0.81] and

Table V A longitudinal, individual analysis of the severity of dysmenorrhoea assessed by the VMS and the VAS in the same women at 19 and 24 years of age, related to change from use to non-use of COCs or the reverse between the two ages.

Age, year		Mean 19 COC	Mean 24 No COC	Difference 19–24 (95% CI)		Mean 19 No COC	Mean 24 COC	Difference 19–24 (95% CI)	Total benefit associated with COC use (95% CI)
VMS									
Cohort-62	33	1.39	1.58	0.18 (−0.12 to 0.48)	84	1.32	0.75	−0.57 (−0.81 to −0.33)	0.75 (0.34–1.17), $P < 0.001$
Cohort-72	34	1.15	1.29	0.15 (−0.16 to 0.46)	52	1.29	0.92	−0.37 (−0.66 to −0.07)	0.51 (0.07–0.95), $P < 0.05$
Cohort-82	39	1.36	1.46	0.10 (−0.14 to 0.35)	31	1.26	1.03	−0.23 (−0.49 to 0.04)	0.33 (−0.03 to 0.68)
All women	106	1.30	1.44	0.14 (−0.02 to 0.30)	167	1.30	0.86	−0.44 (−0.60 to −0.29)	0.58 (0.35–0.81), $P < 0.0001$
VAS									
Cohort-62	36	45.0	49.9	4.9 (−5.7 to 15.2)	84	44.3	24.5	−19.8 (−27.1 to −12.6)	24.7 (11.7–37.7), $P < 0.001$
Cohort-72	34	42.8	44.2	1.5 (−6.4 to 9.4)	50	44.9	31.5	−13.4 (−22.3 to −4.5)	14.9 (2.4–27.4) $P < 0.05$
Cohort-82	38	49.1	48.3	−0.8 (−8.5 to 6.9)	27	54.6	40.0	−14.6 (−24.5 to −4.7)	13.8 (1.74–25.9), $P < 0.05$
All women	108	45.7	47.5	1.8 (−3.1 to 6.8)	161	46.2	29.2	−17.0 (−21.9 to −12.1)	18.8 (11.6–26.0), $P < 0.0001$

Parous women and women fitted with an IUD or using progesterone-only contraception were excluded.

the VAS ($P < 0.0001$, 18.8: CI: 11.6–26.0). Thus in this case–control analysis where each woman was her own control, there was a significant difference in the severity of dysmenorrhoea depending on whether or not the woman used COCs when controlling for age. When analysing the cohorts separately, a corresponding decreased severity of dysmenorrhoea was noted for the 62 and 72 cohorts according to both measurement systems, but in the 82 cohort only when using the VAS.

Factors influencing the severity of dysmenorrhoea

A longitudinal variance analysis was performed utilizing all three cohorts together. Women using an IUD or a progestogen-only method were excluded from these analyses. Factors such as COC use, age, child/no child, smoking/no smoking and BMI were included in the model to find predictors for any change in the severity of dysmenorrhoea. Separate analyses were performed using the two different measures of the severity of dysmenorrhoea, i.e. the VMS system and the VAS as separate dependent variables. Predictors for reducing dysmenorrhoea when using the VMS system were COC use ($P < 0.0001$)—which resulted in a 0.3 unit reduction of dysmenorrhoea—and age ($P < 0.0001$)—which resulted in a reduction of the severity of dysmenorrhoea of 0.1 units per 5 years. There was no significant influence on the severity of dysmenorrhoea assessed by the VMS system due to the birth of a child (−0.07), smoking (0.1) or BMI (−0.01/BMI unit). When using the VAS as a dependent variable, predictors for reducing dysmenorrhoea were COC use ($P < 0.0001$) resulting in a decrease of 9 mm, age ($P < 0.0001$), which resulted in a reduction of 5 mm for the 5-year period and the birth of a child ($P < 0.01$) with a reduction of 7 mm. Smoking (2.13 mm) and BMI (−0.5 mm/BMI unit) did not produce any significant influence. A comparison of the estimated changes in the severity of dysmenorrhoea and observed changes in the severity of dysmenorrhoea over the 5 years period was made and showed a good fit when using both the VMS system ($R^2 = 0.76$, $P < 0.0001$) and the VAS ($R^2 = 0.76$, $P < 0.0001$). We also performed this longitudinal analysis of variance with 'cohort' included in the analysis, as the three cohorts differed in life experiences, which may have influenced the results of this longitudinal analysis. There was no effect of cohort and the identified predictors were unchanged.

Discussion

In this longitudinal cohort study, COC use and increasing age, independent of each other, were associated with a reduced severity of dysmenorrhoea. COC reduced the severity of dysmenorrhoea more than increasing age or childbirth. The decrease in the severity of dysmenorrhoea achieved by COCs was equivalent to the transfer of every third woman one step down on the VMS scale, which—in clinical terms—will result in less pain, improved working ability and a decrease in the need for analgesics.

Two reviews (Proctor and Farquhar, 2007; Wong *et al.*, 2009) have been published assessing the efficacy of COCs in the management of primary dysmenorrhoea. One of these reviews (Proctor and Farquhar, 2007) concluded that it was not possible to say whether COC's reduced the pain of dysmenorrhoea, as the included studies were too small and many of the products assessed were no longer available. A Cochrane review (Wong *et al.*, 2009) that assessed the effectiveness of oral contraceptives for primary dysmenorrhoea concluded that although oral contraceptives are widely advocated as standard treatment, there was only scanty rigorous evidence to support this practice. The authors concluded that it was not possible to conclusively assess the efficacy of oral contraceptives for dysmenorrhoea due to the lack of methodologically sound randomized controlled trials. The Cochrane authors also discussed earlier data from our longitudinal epidemiological study of women in Gothenburg (Milsom *et al.*, 1990) indicating a lower prevalence and severity of dysmenorrhoea in women who were COC users. The Cochrane review authors noted that parity had been controlled for in these analyses but they concluded that the efficacy of COCs could be attributed to the passage

of time. Thus in the present study, we have analysed data, taking into account the influence of age as a confounding factor.

One of the strengths of this study design was that the women in the different groups for the purpose of this analysis served as their own individual controls. In the comparisons, we excluded parous women, as studies have shown reduced severity of dysmenorrhoea after childbirth (Sundell *et al*., 1990). Women fitted with an IUD that may increase the severity of dysmenorrhoea (Grimes *et al*., 2007) were also excluded as well as women using progesterone methods such as progesterone-only pills, implants, the levonorgestrel-releasing intrauterine system (LNG) etc. as they may also potentially influence the severity of dysmenorrhoea. One of the limitations of this study is that few women had given birth to a child, which limited the ability to test the influence of childbirth on the severity of dysmenorrhoea.

Several factors have been reported to influence the severity of dysmenorrhoea such as COC use, age, childbirth, smoking etc. (Andersch and Milsom, 1982a; Milsom *et al*., 1990; Sundell *et al*., 1990; Harlow and Park, 1996; Dawood, 2006). In this study, COC use, age and childbirth were shown to influence the severity of dysmenorrhoea. Childbirth was shown to influence the severity of dysmenorrhoea despite the fact that the reported number of children was low in these three cohorts of women aged 19–24. A longitudinal study (Weismann *et al*., 2004) in women aged between 19 and 44 years followed for 6 years reported that older age and higher parity were associated with less severe dysmenorrhoea. In the same study, tobacco use was also associated with more severe dysmenorrhoea, which could not be confirmed by the present study.

There was a trend over time regarding the severity of dysmenorrhoea when comparing 19- and 24-year-old women from the 62-, 72- and 82-cohorts where women from the 82-cohort reported a greater severity of dysmenorrhoea compared with the other cohorts. In addition, when performing the longitudinal individual analysis, a change in the severity of dysmenorrhoea was more obvious in all measurements recorded for women in the 62- and 72-cohorts compared with the 82-cohort. During the course of this longitudinal study spread over 20 years where 19-year-old women were recruited in 1981, 1991 and 2001, there have been some changes in the types of COC used. The recorded difference between the 82-cohort and the other two cohorts may reflect the use of COCs, which may have been less effective due to a different composition (changes in estrogen and progestogen type and content) or a different appreciation of pain in the younger cohort. Previous studies found that earlier menarche and longer menstrual periods were associated with a higher incidence of dysmenorrhoea (Andersch and Milsom, 1982a; Harlow and Park, 1996). The menarcheal age in these three cohorts of women did n't differ and neither did the length of cycles.

COC use was shown to reduce dysmenorrhoea severity, and this information is important for health providers when informing women of the non-contraceptive benefits of COC during contraceptive counselling (The ESHRE Capri Workshop Group, 2005). It has previously been shown that women who gain relief from dysmenorrhoea while using COCs have a higher continuation rate of COC use (Robinson *et al*., 1992). Self-treatment for dysmenorrhoea is common among adolescent girls and young women (O'Connell *et al*., 2006). Women experiencing dysmenorrhoea on a monthly basis often use non-steroidal anti-inflammatory drugs (NSAIDs) regularly for pain relief and thus the occurrence of adverse events associated with long-term/regular use may be more apparent in this group of women. In a review (Zahradnik *et al*., 2010) on the use of NSAIDs and hormonal contraceptives for the treatment of dysmenorrhoea the authors concluded that COCs were preferential to NSAIDs for women who wish contraception.

Dysmenorrhoea was common in all three cohorts but women from the youngest cohort, the 82 cohort, reported a greater overall severity of dysmenorrhoea. Absenteeism due to dysmenorrhoea was also common, and the use of analgesics due to dysmenorrhoea was reported by approximately one in four women. COC use and increasing age, independent of each other, were shown to reduce dysmenorrhoea severity. Childbirth was also shown to reduce dysmenorrhoea severity, but COC use reduced dysmenorrhoea more than both childbirth and increasing age. Effective management of dysmenorrhoea is beneficial for both the afflicted individual and society and thus the possibility of a beneficial influence of COCs on dysmenorrhoea should be included in contraceptive counselling. However, it is desirable that the findings from this study providing evidence for a beneficial effect of COCs in dysmenorrhoea be confirmed by a placebo-controlled, randomized trial where the efficacy of COCs in dysmenorrhoea are assessed as a primary outcome measure.

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Authors' roles

Study design: I.L., A.A.E. and I.M., execution: I.L. and I.M., analysis: I.L. and I.M., manuscript drafting: I.L., A.A.E. and I.M. and critical discussion: I.L., A.A.E. and I.M.

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Conflict of interest

I.L. and I.M. have, during the past 5 years, participated in clinical trials sponsored by Organon. I.M. has participated in International Advisory Boards sponsored by Organon/Schering-Plough/MSD and Schering/Bayer Pharma. I.M. has received lecture fees for presentations sponsored by Organon, Schering/Bayer and Pfizer. I.L. has received lecture fees from Organon/MSD.

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