Obesity, Polycystic Ovary Syndrome and Breastfeeding: an Observational Study

Running title: PCOS breastfeeding study

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Abstract

Introduction: Polycystic Ovary Syndrome affects nine to 21% of reproductive-aged women. The relationships between PCOS, body mass index (BMI) and breastfeeding are unclear. We aim to examine breastfeeding in women with and without Polycystic Ovary Syndrome (PCOS) and relationship to body mass index (BMI).

Materials and methods: This is a cross-sectional study set in the general community. Participants are women, aged 31-36 years, from the Australian Longitudinal Study on Women's Health (ALSWH), a large community-based study. Data was analysed from the first child of respondents to Survey five (2009) reporting at least one live born child. Logistic regression analysis was used to examine factors associated with breastfeeding. The main outcome measures studied were breastfeeding initiation and duration and the main explanatory variables included self-reported PCOS and BMI.

Results: Of the 4898 women, 6.5% reported PCOS (95% CI: 5.8%-7.2%). Median duration of breastfeeding was lower in women reporting PCOS (6 months, -2 to 14 months) compared to women not reporting PCOS (7 months, -2 to 16 months), $p<0.001$. On multivariable regression analysis, there was no association between PCOS and breastfeeding outcomes. However, being overweight or obese was associated with not initiating breastfeeding and with breastfeeding less than six months, after adjusting for confounders.

Conclusions: High BMI is negatively associated with breastfeeding, whereas PCOS status, per se, does not appear to be related to breastfeeding initiation and duration, after adjusting for BMI.

Keywords
Breastfeeding, PCOS, obesity, BMI, lactation

Abbreviations

ALSWH   Australian Longitudinal Study on Women's Health

BMI   Body Mass Index

CI   Confidence interval

OR   Odds ratio

PCOS   Polycystic Ovary Syndrome

USA   United States of America

Key Message

Women with PCOS have reduced breastfeeding duration compared to women without PCOS

- PCOS is not associated with breastfeeding after adjusting for BMI and other factors
- Being overweight or obese was associated with a greater rate of not initiating breastfeeding and a shorter duration of breastfeeding

Introduction

Polycystic Ovary Syndrome (PCOS) is the most common endocrine disorder to affect women of reproductive age, with significant reproductive (hyperandrogenism, oligovulation/anovulation, infertility), metabolic (dyslipidaemia, type 2 diabetes), and psychological features (depression, anxiety, and poor self-esteem) (1). With prevalence rates of nine to 21%, depending on diagnostic criteria and populations studied, PCOS represents a major health and economic burden (2, 3). Although there is much variation in phenotypic expression, a diagnosis of PCOS is based on two or more features of the following features: irregular cycles/ovulatory dysfunction, clinical/biochemical hyperandrogenism and polycystic ovaries on ultrasound, after exclusion of secondary causes (4).

Observational studies have described reduced lactation in women with PCOS (5, 6). A case control study comprising of 36 women with PCOS and 99 controls concluded that women with PCOS had reduced breastfeeding in the early post-partum period (6). At one month post-partum, 75% of women with PCOS were breastfeeding exclusively compared to 89% of the control group (p=0.001). Another observational study of 186 women revealed that breast size increment during pregnancy in women with PCOS appeared to be inversely related to metabolic parameters and breastfeeding (7).

In terms of pathophysiology, both insulin resistance and hyperandrogenism, which underpin PCOS, have been proposed to inhibit successful breastfeeding (8, 9). Obesity may also play a role in inhibiting breastfeeding in PCOS (10). PCOS appears bi-directionally related to obesity; women with PCOS have a higher body mass index (BMI) and greater weight gain (11) compared to women without PCOS. Obesity, in turn appears to increase the prevalence and severity of PCOS (11, 12). Rates of maternal obesity are rapidly increasing and many pregnant women are now overweight or obese (13). Higher maternal BMI is further exacerbated by excess gestational weight gain and postpartum weight retention (14), leading to increasing rates of obesity in breastfeeding mothers. Breastfeeding is influenced by multiple factors including maternal age, parity, socioeconomic status, education, smoking, infant health problems and also obesity (15, 16). In this context, obesity may confound the study of relationships between PCOS and breastfeeding, given its greater prevalence in PCOS and its apparent impact on breastfeeding; however this has not been adequately explored.

Elucidating the relationship between PCOS, obesity and breastfeeding has significant public health implications. PCOS and BMI are not currently clinically recognised to have a detrimental impact on breastfeeding and affected mothers are not generally offered additional lactation assistance. This study aims to investigate the relationship between self-reported PCOS, BMI and breastfeeding (initiation and duration) by analysing survey data from the large, prospective community-based Australian Longitudinal Study on Women's Health (ALSWH).

Materials and methods

The ALSWH first collected mailed survey data from three age cohorts of Australian women in 1996. Women were randomly selected from the national health insurance (Medicare) database comprising almost all Australian citizens and permanent residents (17). Women were recruited nationally with deliberate over-sampling from rural and remote areas (17). The study aimed to examine the relationships between biological, psychological, social, lifestyle factors, women's physical and mental health, and their use of and satisfaction with health care services (17, 18). Further details of the methods used by the ALSWH and characteristics of the sample are reported elsewhere (www.alswh.org.au) (19).

Using the cohort of women born from 1973-1978, this study analysed data collected at Survey five (conducted in 2009). Data were analysed from the first birth of respondents who reported at least one live born child. In 1996, this cohort originally included 14247 women, of whom 8200 (58%) were still participating at Survey five (Figure 1). Survey five was used for this analysis as women were aged 31-36 by this survey and 64% of the women had children by this survey.

All study methods were approved by the Human Research Ethics Committees of the University of Newcastle (approval date 26/7/1995, approval number H-076-0795) and University of Queensland (approval year 2004, approval number 2004 000 224).

Measures

Primary outcome variables

At Survey five, women were asked the number of complete months they had breastfed each of their children. The breastfeeding duration for the first live birth was analysed. From this survey question, two outcome variables were derived: breastfeeding for at least one month, categorised as yes/no and classified as breastfeeding initiation for the purposes of the current study and breastfeeding duration greater than six months, categorised as yes/no. If women breastfed for between one to six months, they were categorised as having initiated breastfeeding, but not breastfeeding for greater than six months.

Explanatory variables

PCOS status was determined based on self-reported status at Surveys four and five. Women were asked if they had been diagnosed or treated for PCOS in the previous three years. Women were considered to have PCOS if they responded "yes" to this question in either Survey four or five. Individual clinical diagnostic features of PCOS were not included in the surveys, except for menstrual cycle regularity. Self-reported PCOS shows high correlation with irregular cycles in this cohort, as reported previously (11).

BMI was calculated from self-reported height and weight. Mean BMI from the period between 1996 and 2009 was calculated from BMI reported on Surveys one to five. Mean BMI was calculated as the BMI from Survey five may not correspond to the BMI during the period of breastfeeding. The mean BMI was then classified as healthy weight BMI 18.5 – 24.9 kg/m^2, overweight BMI 25.0 – 29.9 kg/m^2 and obese BMI $\geq$ 30 kg/m^2 using the World Health Organisation criteria.

Other explanatory variables self-reported at Survey five included demographic factors such as education, occupation, household income, smoking status and area of residence; pregnancy complications including gestational diabetes and hypertension in each pregnancy; birth complications for each child including prematurity, low birthweight, forceps or vacuum delivery and cesarean section and psychological factors including depression, anxiety, postnatal depression and postnatal anxiety.

Statistical analysis

Continuous variables were summarised as means with standard deviation and categorical outcomes reported as percentages. Differences in variables at baseline between PCOS status groups were tested using a t-test, wilcoxon rank sum test or a chi-squared test, as appropriate. To assess the relationship between PCOS and BMI on breastfeeding initiation and duration for the first live birth, logistic regression analyses were performed and adjusted for potential confounding covariates including age, mean BMI, pregnancy complications (gestational diabetes, hypertension in pregnancy), birth complications (premature birth, low birthweight, instrumental delivery, Cesarean section), mood disorders and demographic factors. The selection of variables was based on identifying all measured clinical variables of known or suspected prognostic importance for the outcome of interest (and/or exhibiting p<0.1 on univariate analyses). Given the deliberate oversampling from rural and remote areas, the logistic regression was adjusted by area of residence. All analyses were performed using Stata software version 11.0 (StataCorp, Texas, USA).

Results

From 8200 respondents at Survey five, 4898 women provided a valid response to the questions concerning breastfeeding, PCOS (on Survey four or five), provided data on BMI (on at least one survey from Surveys one to five) and had at least one live birth (Figure 1). Self-reported PCOS prevalence was 7.1% in the overall cohort of women born 1973-1978 (95% CI 6.6% - 7.7%) compared with a PCOS prevalence of 6.5% (95% CI: 5.8%-7.2%) for women included in this study.

The mean BMI was higher in women with PCOS (mean difference 2.2 kg/m^2, 95% CI 1.7 – 2.8 kg/m^2). Women reporting a PCOS diagnosis were more likely to report pregnancy complications including gestational diabetes (mean difference 5.5%, 95% CI 2.3 – 8.7%) and hypertension in pregnancy (mean difference 4.3%, 95% CI 0.1 – 8.4%). Compared to women not reporting PCOS, women reporting a PCOS diagnosis were more likely to report Cesarean section (mean difference 10.0%, 95% CI 4.6 - 15.4%), premature birth (mean difference 10.2%, 95% CI 5.6 - 14.7%) and low infant birthweight (mean difference 6.4%, 95% CI 2.8 - 10.0%) (Table 1). The prevalence of mood disorders was higher in women who reported PCOS including depression (mean difference 6.1%, 95% CI 1.3 - 10.8%), anxiety (mean

difference 4.3%, 95% CI 0.6 - 8.1%) and postnatal depression (mean difference 4.9%, 95% CI 0.9 - 8.9%) compared to women not reporting PCOS.

There was a higher proportion of women in the PCOS group who did not initiate breastfeeding when compared to women who did not report having PCOS (mean difference 2.3%, 95% CI -1.2 – 5.9%). Overall, median duration of breastfeeding was lower in women reporting PCOS (6 months, -2 to 14 months) compared to women not reporting PCOS (7 months, -2 to 16 months), p<0.001. Breastfeeding of six months or less duration was reported in 54.2% of women reporting PCOS, compared to 44.3% of women not reporting PCOS (mean difference 9.9%, 95% CI 3.9 – 15.9%).

There was little evidence to suggest that PCOS status was associated with no initiation of breastfeeding, either by itself or in the presence of other factors (Table 2). Being overweight or obese was associated with higher odds of not initiating breastfeeding after adjusting for other variables.

PCOS status was not associated with breastfeeding duration of six months or less, either by itself or in the presence of other explanatory factors (Table 3). Overweight and obese BMI categories were both positively associated with breastfeeding duration of six months or less (Table 3) after adjusting for other factors.

Discussion

This novel study examines self-reported data on breastfeeding history of women with PCOS, compared to those without PCOS, in a large community-based cohort of women aged 31-36 years, with specific focus on breastfeeding initiation, duration and relationship with PCOS status and BMI. We note that 6.5% of parous women reported PCOS diagnosis and those with PCOS had an increased BMI. We advance knowledge in this field by showing that on multivariate analysis, PCOS status was not associated with not initiating breastfeeding or breastfeeding duration of six months or less. Overweight and obesity were independently associated with not initiating breastfeeding and with breastfeeding duration of six months or less.

In this study, PCOS status relied upon self-reported diagnosed PCOS. Previously published data indicates that PCOS status strongly correlates with menstrual irregularity in this cohort of women, supporting self-reported PCOS status (11). The results by Survey five show reported PCOS rates of 7.1% overall and 6.5% in the subgroup of women with a history of one or more live birth. This compared to rates of 5.8% observed in the overall cohort in the previous survey conducted in 2006. The apparent increase in prevalence may reflect greater awareness amongst healthcare professionals and the general public after a major national initiative including guideline and dissemination on PCOS (1, 20). Also, since 2006, more women have tried for a family, have been diagnosed with infertility and investigated for PCOS, potentially increasing PCOS diagnosis. The observed rise in obesity amongst women of reproductive age may also increase prevalence and severity of PCOS, with prior analysis of the ALSWH showing higher prevalence of PCOS with higher BMI (11, 21). PCOS prevalence also varies depending on the diagnostic criteria and population studied (2, 3). Recent Australian community prevalence data shows 9-21% of women have PCOS suggesting under-diagnosis in the current study (2, 3, 21). The lower prevalence rate of PCOS reported here is more likely to reflect that up to 70% of Australian women with PCOS remain undiagnosed (2), highlighting the need for increased awareness to optimise diagnosis and facilitate early treatment.

PCOS has not been clinically recognised to influence breastfeeding and the current study is the first large community-based cohort study to investigate this. Mechanistically,

hyperandrogenism, a prominent feature of PCOS is associated with reduced lactation (9). Other previously proposed mechanisms for impaired breastfeeding in PCOS include inhibition of the transformation of breast tissue to prepare for lactation, direct inhibition of lactation and psychological effect of androgens potentially reducing dedication to breastfeeding (22). However, these studies did not adjust for the confounding effect of obesity. PCOS is also underpinned by insulin resistance and hyperinsulinemia, which may enhance effects of prolactin on mammary cell proliferation. Reduced breast size increment during pregnancy has been correlated with higher insulin levels, greater metabolic dysfunction and reduced breastfeeding in PCOS (7). Despite postulated mechanisms and preliminary data from small studies suggesting reduced breastfeeding in PCOS, in this current large community-based cohort study, non-initiation of breastfeeding and breastfeeding for six months or less in PCOS appear to be related to greater BMI, not PCOS status per se, with BMI also known to drive hyperandrogenism and insulin resistance.

Physiological, social and cultural variables influence the relationship between BMI and breastfeeding. Steroid hormones are produced and stored in adipose tissue, which is proposed to cause higher progesterone levels in obese women, disrupting the usual drop in progesterone which precipitates lactogenesis (23). Overweight women may have increased breast size presenting potential mechanical breastfeeding difficulties including with attachment (24). Overweight women are also more likely to have medical and obstetric complications and interventions, known to influence breastfeeding (25, 26). A recent review comprising 19 studies from 1997-2011 investigating the interplay of BMI and breastfeeding, observed that maternal obesity was an adverse determinant of breastfeeding success and was associated with a decreased intention to breastfeed, delayed onset of lactogenesis decreased breastfeeding initiation rates, shortened duration of breastfeeding and less adequate milk supply compared to non-obese mothers (10). Our current findings were consistent with prior literature showing a strong relationship between BMI and breast feeding initiation and duration. Breastfeeding has been associated with many health advantages including reduced obesity in mothers and children (27, 28), although the impact of breastfeeding duration on childhood obesity remains controversial (29). Yet overweight and obese mothers are not currently provided with extra support to promote breastfeeding (30). Arguably, a greater focus on support and education to promote breastfeeding in overweight mothers is needed.

The strengths of this study include the large, unselected community cohort. Attrition is noted, however the impact of attrition on associations between variables in this large cohort study has been found to be minimal (19, 31). A comparison of women who participated in the baseline survey with data from women in the same age range from the Australian census of 1996 indicates that women from the ALSWH are representative of the general population (17). The study also had a high baseline participation rate and utilised prospective data with limited information bias. The current study focused on diagnosed PCOS, whereas many other studies in this area have used menstrual irregularity as a surrogate marker of PCOS. Self-reported endpoints are a limitation of the current study; however reliance on self-reported data is generic in large prospective long-term community-based cohort studies. The accuracy of self-reported data could be different for different variables, for example breastfeeding duration may be more accurately recalled whereas weight is often underreported. However, Self-reported BMI has been validated and has been found to correlate well with measured BMI in another age cohort of the same study (32). There was no available data on the exclusivity of breastfeeding as a source of child nutrition. The survey question regarding breastfeeding asked regarding number of complete months of breastfeeding, therefore women who initiated breastfeeding, but breastfed for less than one month will be represented in the group who did not initiate breastfeeding. This may underestimate breastfeeding initiation rates. The likely under-reporting of PCOS would be expected to minimise the differences observed between the groups and the findings presented here may underrepresent the relationship of PCOS to breastfeeding. In the current study, timing of PCOS diagnosis, pregnancy and breastfeeding were not specifically ascertained. Mean BMI from all five surveys was used for analysis, but may not reflect the BMI at the time of breastfeeding. Yet, we have previously published longitudinal BMI data from this study noting higher BMI in PCOS subjects across the duration of the study (11). The prevalence of birth complications including premature birth was self-reported. The definition of premature birth (< 37 weeks gestation) was not provided in the survey. Women may have reported a birth as premature if the birth occurred before the estimated due date, therefore overestimating the prevalence of premature birth.

The results of this study suggest that mothers with increased BMI have lower breastfeeding initiation and duration. PCOS alone does not appear to be related to breastfeeding. The importance of peri-partum weight is emphasised by these findings. Given the increasing prevalence of obesity in women of reproductive age and the importance of breastfeeding to

maternal weight retention and to infant and child health, further research is needed to clarify whether targeted interventions to promote successful breastfeeding has any effect in overweight mothers.

Conflict of interest

The authors have no conflict of interest to declare.

References

1. Teede H, Deeks A, Moran L. Polycystic ovary syndrome: a complex condition with psychological, reproductive and metabolic manifestations that impacts on health across the lifespan. BMC Med. 2010;8:41.

2. March WA, Moore VM, Willson KJ, Phillips DI, Norman RJ, Davies MJ. The prevalence of polycystic ovary syndrome in a community sample assessed under contrasting diagnostic criteria. Hum Reprod. 2010;25(2):544-51.

3. Boyle JA, Cunningham J, O'Dea K, Dunbar T, Norman RJ. Prevalence of polycystic ovary syndrome in a sample of Indigenous women in Darwin, Australia. Med J Aust. 2012;196(1):62-6.

4. The Rotterdam ESHRE/ASRM-Sponsored PCOS Consensus Workshop Group. Revised 2003 consensus on diagnostic criteria and long-term health risks related to polycystic ovary syndrome. Fertil Steril. 2004;81(1):19-25.

5. Marasco L, Marmet C, Shell E. Polycystic ovary syndrome: a connection to insufficient milk supply? J Hum Lact. 2000;16(2):143-8.

6. Vanky E, Isaksen H, Moen MH, Carlsen SM. Breastfeeding in polycystic ovary syndrome. Acta Obstet Gynecol Scand. 2008;87(5):531-5.

7. Vanky E, Nordskar JJ, Leithe H, Hjorth-Hansen AK, Martinussen M, Carlsen SM. Breast size increment during pregnancy and breastfeeding in mothers with polycystic ovary syndrome: a follow-up study of a randomised controlled trial on metformin versus placebo. BJOG. 2012;119(11):1403-9.

8. Lawrence RA. Breastfeeding: A guide for the medical profession. 5th ed. St Louis: Mosby; 1999.

9. Leeners B, Rath W, Kuse S, Neumaier-Wagner P. Breast-feeding in women with hypertensive disorders in pregnancy. Journal of Perinatal Medicine. 2005;33(6):553-60.

10. Turcksin R, Bel S, Galjaard S, Devlieger R. Maternal obesity and breastfeeding intention, initiation, intensity and duration: a systematic review. Maternal & child nutrition. 2014;10(2):166-83.

11. Teede HJ, Joham AE, Paul E, Moran LJ, Loxton D, Jolley D, et al. Longitudinal weight gain in women identified with polycystic ovary syndrome: results of an observational study in young women. Obesity (Silver Spring). 2013;21(8):1526-32.

12. Stepto NK, Cassar S, Joham AE, Hutchison SK, Harrison CL, Goldstein RF, et al. Women with polycystic ovary syndrome have intrinsic insulin resistance on euglycaemic-hyperinsulaemic clamp. Hum Reprod. 2013;28(3):777-84.

13. Teede HJ, Harrison CL, Teh WT, Paul E, Allan CA. Gestational diabetes: Development of an early risk prediction tool to facilitate opportunities for prevention. Australian and New Zealand Journal of Obstetrics and Gynaecology. 2011;51(6):499-504.

14. Chu SY, Callaghan WM, Bish CL, D'Angelo D. Gestational weight gain by body mass index among US women delivering live births, 2004-2005: fueling future obesity. American Journal of Obstetrics & Gynecology. 2009;200(3):271.e1-7.

15. Scott JA, Binns CW. Factors associated with the initiation and duration of breastfeeding: a review of the literature. Breastfeed Rev. 1999;7(1):5-16.

16. Lovelady CA. Is maternal obesity a cause of poor lactation performance. Nutr Rev. 2005;63(10):352-5.

17. Lee C, Dobson AJ, Brown WJ, Bryson L, Byles J, Warner-Smith P, et al. Cohort Profile: The Australian longitudinal study on Women's Health. Int J Epidemiol. 2005;34(5):987-91.

18. Lee. Women's Health Australia: Progress on the Australian Longitudinal Study on Women's Health 1995–2000. Brisbane: Australian Academic Press Pty Ltd.; 2001.

19. Powers J, Loxton D. The Impact of Attrition in an 11-Year Prospective Longitudinal Study of Younger Women. Annals of Epidemiology. 2010;20(4):318-21.

20. Misso M, Boyle J, Norman R, Teede H. Development of evidenced-based guidelines for PCOS and implications for community health. Semin Reprod Med. 2014;32(3):230-40.

21. Yildiz BO, Bozdag G, Yapici Z, Esinler I, Yarali H. Prevalence, phenotype and cardiometabolic risk of polycystic ovary syndrome under different diagnostic criteria. Human Reprduction. 2012;27(10):3067-73.

22. Carlsen SM, Jacobsen G, Vanky E. Mid-pregnancy androgen levels are negatively associated with breastfeeding. Acta Obstet Gynecol Scand. 2010;89(1):87-94.

23. Akre J. Infant feeding. The physiological basis. Bulletin of the World Health Organization. 1989;67 Suppl:1-108.

24. Coates MM. Assisting the newborn to latch on to the very large breast: help! J Hum Lact. 1989;5(3):131-2.

25. Kitsantas P, Pawloski LR. Maternal obesity, health status during pregnancy, and breastfeeding initiation and duration. J Matern Fetal Neonatal Med. 2010;23(2):135-41.

26. Rowe-Murray HJ, Fisher JR. Baby friendly hospital practices: cesarean section is a persistent barrier to early initiation of breastfeeding. Birth. 2002;29(2):124-31.

27. Labbok MH. Health sequelae of breastfeeding for the mother. Clinics in perinatology. 1999;26(2):491-503, viii-ix.

28. Gillman MW. Commentary: breastfeeding and obesity--the 2011 Scorecard. International journal of epidemiology. 2011;40(3):681-4.

29. Kramer MS, Matush L, Vanilovich I, Platt RW, Bogdanovich N, Sevkovskaya Z, et al. A randomized breast-feeding promotion intervention did not reduce child obesity in Belarus. The Journal of nutrition. 2009;139(2):417s-21s.

30. Rasmussen KM, Lee VE, Ledkovsky TB, Kjolhede CL. A description of lactation counseling practices that are used with obese mothers. J Hum Lact. 2006;22(3):322-7.

Table 1: Participant characteristics according to Polycystic Ovary Syndrome (PCOS) status among 4898 women born 1973-1978 from the Australian Longitudinal Study on Women's Health

Characteristic	PCOS (n=320)	No PCOS (n=4578)	P
Age (years)	33.6 ± 1.4	33.9 ± 1.5	*0.004*
Body Mass Index (BMI, kg/m^2 *)*			
Mean BMI	26.7 ± 6.0	24.5 ± 4.8	*<0.001*
Underweight - BMI < 18.5	7 (2.2)	147 (3.2)	*<0.001*
Healthy weight - BMI 18.5 – 24.9	142 (44.4)	2806 (61.3)	
Overweight - BMI 25.0 – 29.9	80 (25.0)	1098 (24.0)	
Obese - BMI ≥ 30.0	91 (28.4)	527 (11.5)	
Smoker (casual or daily)	45 (14.1)	523 (11.4)	0.16
Marital status			
Never married	17 (5.3)	148 (3.2)	0.14
Married	256 (80.3)	3616 (79.3)	
Widowed, separated, divorced	15 (4.7)	266 (5.8)	
De facto	31 (9.7)	533 (11.7)	
Highest qualification			
Year 12 or less	74 (24.0)	1118 (25.0)	0.81
Trade/ certificate	85 (27.5)	1267 (28.3)	
University/ higher university degree	150 (48.5)	2085 (46.6)	
Main occupation			
No paid job	92 (29.6)	1354 (30.2)	0.96
Trades and services	54 (17.4)	820 (18.3)	
Advanced trades and services	51 (16.4)	724 (16.2)	
Professional	114 (36.7)	1586 (35.4)	
Annual household income			
Less than $25,999	17 (5.9)	175 (4.3)	0.06
$26,000 – $77,999	99 (34.5)	1546 (37.6)	
$78,000 - $155,999	129 (45.0)	1958 (47.7)	
Greater than $156,000	42 (14.6)	428 (10.4)	
Antenatal complications			

Gestational diabetes	29 (9.1)	163 (3.6)	*<0.001*
Hypertension in pregnancy	52 (16.3)	548 (12.0)	*0.02*
Birth complications			
Pre-term birth	67 (20.9)	492 (10.8)	*<0.001*
Low birthweight < 2.5kg	39 (12.2)	265 (5.8)	*<0.001*
Forceps or vacuum extraction	76 (23.8)	1102 (24.1)	0.90
Cesarean section	117 (36.6)	1215 (26.6)	*<0.001*
Pre-existing mood disorder			
Depression	69 (22.1)	680 (16.0)	*0.01*
Anxiety	38 (12.2)	332 (7.8)	*0.01*
Postnatal mood complications			
Postnatal depression	48 (15.0)	461 (10.1)	*0.01*
Postnatal anxiety	25 (7.8)	240 (5.2)	*0.05*

Values are reported as mean ± SD or as counts with percentages.

BMI, Body Mass Index; PCOS, Polycystic Ovary Syndrome

Table 2: Association (odds ratio) of Polycystic Ovary Syndrome (PCOS) and Body Mass Index (BMI) with no initiation of breastfeeding, in a cohort of 4898 women aged 31 to 36 years old

	Univariable results			*Multivariable results*		
	OR	*95% CI*	*p*	*OR*	*95% CI*	*p*
PCOS	1.3	0.9 – 1.9	0.15	0.9	0.6 – 1.4	0.69
Age	1.0	0.9 – 1.1	0.91			
Smoking	1.7	1.3 – 2.2	<0.001	1.1	0.8 – 1.5	0.67
BMI category						
BMI < 18.5	2.3	1.4 – 3.8	0.001	1.3	0.6 – 2.5	0.52
BMI 18.5 – 24.9 [a]	1			1		
BMI 25.0 – 29.9	2.0	1.6 – 2.6	<0.001	1.7	1.3 – 2.3	<0.001
BMI ≥ 30.0	3.3	2.6 – 4.3	<0.001	2.8	2.0 – 3.8	<0.001
Qualification						
Year 12 or less [a]	1			1		
Trade/ certificate	0.8	0.6 – 1.0	0.10	1.0	0.8 – 1.3	0.95
University degree	0.4	0.3 – 0.6	<0.001	0.6	0.5 – 0.9	0.02
Occupation						
No paid job [a]	1			1		
Trades and services	1.7	1.3 – 2.2	<0.001	1.6	1.2 – 2.3	0.003
Advanced trades and services	1.2	0.9 -1.6	0.20	1.2	0.8 – 1.7	0.30
Professional	0.8	0.6 – 1.1	0.11	1.2	0.9 – 1.7	0.28
Household income (annual)						
Less than $25,999 [a]	1			1		
$26,000 – $77,999	0.7	0.5 – 1.1	0.15	0.8	0.5 – 1.3	0.30
$78,000 - $155,999	0.6	0.4 – 0.9	0.01	0.7	0.4 – 1.2	0.18
Greater than $156,000	0.5	0.3 – 0.9	0.02	0.9	0.5 – 1.6	0.61

Antenatal complications						
Gestational diabetes	1.5	1.0 – 2.4	0.06	1.2	0.7 – 2.0	0.45
Hypertension in pregnancy	1.5	1.2 – 2.0	0.001	1.0	0.7 – 1.3	0.86
Birth complications						
Premature birth	1.8	1.4 – 2.3	<0.001	1.2	0.8 – 1.8	0.33
Low birthweight < 2.5kg	2.1	1.5 – 2.9	<0.001	2.0	1.3 – 3.1	0.003
Cesarean section	1.4	1.1 – 1.7	0.003	1.2	0.9 – 1.5	0.24
Pre-existing mood disorder						
Depression	1.7	1.4 – 2.2	<0.001	1.3	1.0 – 1.9	0.07
Anxiety	1.7	1.3 – 2.4	0.001	1.3	0.9 – 2.0	0.17
Postnatal mood complications						
Postnatal depression	1.9	1.5 – 2.5	<0.001	1.3	0.9 – 1.8	0.19
Postnatal anxiety	1.3	0.9 – 1.9	0.19			

[a] Reference category

All estimates are adjusted for area of residence to account for over sampling of women from rural and remote areas

BMI, Body Mass Index; PCOS, Polycystic Ovary Syndrome

Table 3: Association (odds ratio) of Polycystic Ovary Syndrome (PCOS) and Body Mass Index (BMI) with breastfeeding duration of 6 months or less, in a cohort of 4898 women aged 31 to 36 years old

	Univariable results			*Multivariable results*		
	OR	**95% CI**	**P**	**OR**	**95% CI**	**P**
PCOS	1.5	1.2 – 1.9	0.001	1.2	0.9 – 1.6	0.17
Age	1.0	1.0 – 1.0	0.96			
Smoking	2.4	2.0 – 3.0	<0.001	1.8	1.5 – 2.3	<0.001
BMI category						
BMI < 18.5	1.2	0.8 – 1.6	0.41	1.1	0.7 – 1.6	0.69
BMI 18.5 – 24.9 [a]	1			1		
BMI 25.0 – 29.9	1.5	1.3 – 1.8	<0.001	1.3	1.1 – 1.5	0.001
BMI ≥ 30.0	2.0	1.6 – 2.4	<0.001	1.4	1.2 – 1.8	0.001
Qualification						
Year 12 or less [a]	1			1		
Trade/ certificate	0.8	0.7 – 0.9	0.003	0.8	0.7 – 0.97	0.02
University/ higher university degree	0.4	0.4 – 0.5	<0.001	0.5	0.4 – 0.6	<0.001
Occupation						
No paid job	1			1		
Trades and services	1.6	1.3 – 1.9	<0.001	1.3	1.0 – 1.6	0.02
Advanced trades and services	1.5	1.2 – 1.7	<0.001	1.3	1.1 – 1.6	0.01
Professional	0.9	0.8 – 1.0	0.13	1.2	1.0 – 1.5	0.03
Household income						
Less than $25,999 [a]						
$26,000 – $77,999	1.1	0.8 – 1.5	0.70			
$78,000 - $155,999	0.9	0.7 – 1.2	0.53			
Greater than $156,000	0.8	0.6 – 1.2	0.38			
Antenatal complications						
Gestational diabetes	1.7	1.2 – 2.3	0.001	1.4	1.0 – 2.0	0.05
Hypertension in	1.5	1.3 – 1.8	<0.001	1.3	1.05 – 1.6	0.02

pregnancy

Birth complications

Multiple birth	1.7	1.0 – 2.8	0.03	1.3	0.8 – 2.4	0.32
Premature birth	1.5	1.2 – 1.8	<0.001	1.2	0.9 – 1.5	0.15
Low birthweight baby < 2.5kg	1.4	1.1 – 1.9	0.01	1.0	0.7 – 1.4	0.94
Cesarean section	1.4	1.2 – 1.5	<0.001	1.3	1.1 – 1.5	<0.001
Pre-existing mood disorder						
Depression	1.4	1.2 – 1.7	<0.001	1.0	0.8 – 1.3	0.79
Anxiety	1.6	1.3 – 2.0	<0.001	1.3	1.0 – 1.7	0.06
Postnatal mood complications						
Postnatal depression	1.8	1.5 – 2.2	<0.001	1.4	1.1 – 1.8	0.01
Postnatal anxiety	1.6	1.2 – 2.0	0.001	1.2	0.9 – 1.7	0.18

[a] Reference category

All estimates are adjusted for area of residence to account for over sampling of women from rural and remote areas

BMI, Body Mass Index; PCOS, Polycystic Ovary Syndrome

Figure 1: Participant selection for a study of Polycystic Ovary Syndrome, body mass index and breastfeeding among the 1973-1978 birth cohort participants from the Australian Longitudinal Study on Women's Health

ALSWH: Australian Longitudinal Study of Women's Health; PCOS: Polycystic Ovary Syndrome; BMI: Body Mass Index