Drug and Alcohol Dependence 228 (2021) 109023

Contents lists available at ScienceDirect

Drug and Alcohol Dependence

journal homepage: www.elsevier.com/locate/drugalcdep

Pregnant women's alcohol consumption and knowledge about its risks: An Israeli survey

Liat Hen-Herbst [a,b,*], Ariel Tenenbaum [c], Yehuda Senecky [d], Andrea Berger [e]

[a] Department of Occupational Therapy, Faculty of Health Sciences, Ariel University, Ariel, Israel
[b] Department of Occupational Therapy, Faculty of Social Welfare & Health Sciences, University of Haifa, Mount Carmel, Haifa, Israel
[c] Medical Unit for Adoption and Foster Care, Department of Pediatrics, Hadassah Medical Center and the Faculty of Medicine, The Hebrew University of Jerusalem, Israel
[d] Department of Pediatric Neurology and Child Development, Schneider Children's Medical Center of Israel, Petach Tikva, Israel
[e] Department of Psychology and Zlotowski Center for Neuroscience, Ben-Gurion University of the Negev, Beer Sheva, Israel

ARTICLE INFO

Keywords:
Prenatal alcohol exposure
Fetal alcohol spectrum disorder
FASD
Alcohol consumption
Pregnancy

ABSTRACT

Background: Alcohol consumption is found in a significant proportion of women during their pregnancies. The only study on the prevalence of alcohol consumption during pregnancy in Israel was conducted over a decade ago. Thus, our study aimed to assess alcohol consumption before and during pregnancy, associations with demographic characteristics, knowledge of possible risks of prenatal alcohol exposure, and relations among such knowledge, sociodemographic characteristics, and drinking habits.

Methods: A convenience sample of 802 pregnant Israeli women completed an anonymous online questionnaire regarding their alcohol consumption during pregnancy, recommendations received, and knowledge of possible risks.

Results: Of the sample, 539 (67.2 %) women self-reported drinking alcohol in the 2 months prior to learning they were pregnant, and 96 (12 %) during their pregnancy. Twice as many (28.1 %) reported knowing other women who had consumed alcohol during pregnancy. Women with higher education, in their first pregnancies, ethnically Jewish, and secular reported the highest pre-pregnancy rates of alcohol consumption. About 40 % reported receiving no education about the dangers of alcohol consumption during pregnancy.

Conclusions: A concerning percentage of pregnant women in Israel acknowledge drinking alcohol near and after conception. Although most participants reported discontinuing use after realizing they were pregnant, a worrying percentage continued consumption with little knowledge of the dangers. Actual rates may be higher. Information about risks of prenatal alcohol exposure is not widely disseminated, emphasizing the need to increase public awareness.

1. Introduction

Alcohol has been and remains the drug most commonly used by women of reproductive age (Oei, 2020). Over the past 30 years, young women worldwide have been consuming more alcohol and with increasingly frequent patterns of risky behavior, such as "binge drinking" (four or more drinks in 2 h; Roozen et al., 2018). Unfortunately, alcohol consumption is also found in a significant proportion of women during their pregnancies. Popova et al.'s (2017) comprehensive systematic literature search and meta-analysis revealed that 10 %–15 % of pregnant women in Canada and the United States, respectively, consume alcohol, and about 3 % in both countries engage in binge drinking. There is no precise estimate of alcohol consumption by pregnant women in the European Union (Mendoza et al., 2020), but in a study carried out in 11 European countries, 15.8 % of the samples of pregnant and puerperal women reported they consumed alcohol during pregnancy (Mårdby et al., 2017). The global prevalence (according to the World Health Organization [WHO] European Region) was estimated at 25.2 % (Popova et al., 2017). Based on these shreds of evidence, it should not be surprising that prenatal alcohol exposure (PAE) is a global health problem (Popova et al., 2017). Prevalence estimates of PAE vary around the world, from 4.1 % in Norway (Mårdby et al., 2017) and 7.3 % in the United States (Green et al., 2016) to 60.4 % in Ireland (Popova et al., 2017).

So far, only one study has been conducted in Israel on alcohol consumption during pregnancy, and it was carried out over a decade ago

* Corresponding author at: Dept. of Occupational Therapy, Faculty of Health Sciences, Ariel University, Ariel, 40700, Israel.
E-mail address: liathe@ariel.ac.il (L. Hen-Herbst).

https://doi.org/10.1016/j.drugalcdep.2021.109023
Received 3 May 2021; Received in revised form 10 July 2021; Accepted 21 July 2021
Available online 4 September 2021

(Senecky et al., 2011). In that study, 3,815 new mothers completed an ad hoc questionnaire on their personal drinking habits during pregnancy. The researchers reported a 14.1 % alcohol-consumption rate during pregnancy, with higher risks among older women, women with first pregnancies, and secular women. Among religious groups, the percentage of women who reported drinking alcohol (15.5 % for Jewish women, 11.1 % for Christians, and 0 % for Muslims) was lower than the percentage who claimed they knew someone who drank alcohol during pregnancy (26.0 %, 27.8 %, and 4.8 %, respectively). According to those authors, these results suggested that the real rates of drinking during pregnancy could have been even higher than reported rates, based on the willingness of the women to acknowledge such consumption.

Alcohol consumption during pregnancy can negatively affect fetal development and result in a range of mental and physical disabilities clinically termed fetal alcohol spectrum disorders (FASD; Brown et al., 2019). Epidemiological research implied that FASD is a worldwide problem (Roozen et al., 2018) and the leading preventable cause of birth defects and developmental disabilities (Gahagan et al., 2006). Recent estimations indicated that FASD will affect approximately one in every 13 prenatally alcohol-exposed infants—approximately 630,000 infants in the world—each year. The FASD prevalence in populations of younger school children may be as high as 2 %–5 % in the United States and some Western European countries (Lange et al., 2017).

The main knowledge deficits about FASD are no clear pathophysiological understanding, no cure, no dose–response curve for alcohol intake during pregnancy, and no reliable biomarker for FASD detection or assessment criteria of individual susceptibility (Ehrhart et al., 2019). Specifically, mothers of children diagnosed on the spectrum reported alcohol-consumption levels ranging from mild to excessive (i.e., "binge drinking"; Esper and Furtado, 2014; Flak et al., 2014). Not every woman who drinks during pregnancy will deliver a child with FASD. However, research has not yet delineated the pattern, amount, or critical period of PAE necessary to cause FASD (Popova et al., 2017). Although there is no known safe amount of alcohol that can be consumed while pregnant (Charness et al., 2016; WHO, 2014), it appears that even lower amounts of alcohol can have serious risks for the development of an unborn child (Mamluk et al., 2017). Therefore, any amount of PAE might be considered dangerous. Given that the pattern, amount, and critical PAE period necessary for structural or functional teratogenesis are unknown, a growing number of countries have modified clinical-practice guidelines to advise health professionals to promote total avoidance of alcohol throughout pregnancy (Mendoza et al., 2020). Israeli Ministry of Health (2021) guidelines advise women to completely abstain from alcohol when they are trying to conceive and throughout their pregnancy but have no standard process to inform women of the risks. Likewise, there have been no studies on the extent to which pregnant women receive health advice on alcohol consumption.

Women who are not well informed about the hazards of alcohol consumption during pregnancy may not comply with national recommendations or change their behaviors, attitudes, or knowledge levels (Kesmodel and Urbute, 2019). For example, Tough et al. (2005) indicated that less than half of family physicians in Canada discussed the risks of alcohol use, drug use, or smoking during pregnancy with women of childbearing age. According to the single Israeli study conducted (Senecky et al., 2011), only a minority of women received guidance from a qualified professional regarding these risks.

Awareness of this topic might have improved over time, given the availability of online information and widespread knowledge that characterized the last decade. Young et al.'s (2018) review showed little evidence that mass media campaigns reduced alcohol consumption (although most campaigns did not state reduction as an aim). Other studies showed that campaign recall was high and can influence knowledge, attitudes, and beliefs about alcohol consumption. Yet, according to Hasking and Schofield (2015), attitudes about drinking, perceptions, perceived behavioral control, and self-efficacy explain only 60 % of the variance in drinking behavior among university students. Those researchers called for further work to investigate the role of knowledge in limiting alcohol-related harms.

According to Tsang et al.'s (2020) recent study, women in Australia used various information sources to learn about the risks of alcohol use during pregnancy but reported strong preference for health care professionals as their primary source of information. Anderson et al. (2014) found that when women received conflicting information from multiple sources regarding alcohol use, they created a hierarchy of information with health care providers at the top. That is, the women tended to believe these providers held expert knowledge and relied on them to explain contradictory information.

This study aimed to assess (a) alcohol-consumption behavior before and during pregnancy among a sample of pregnant women in Israel; (b) associations between consumption and sociodemographic characteristics; (c) available information resources regarding possible risks of alcohol consumption and PAE; and (d) relations between such knowledge and the women's sociodemographic characteristics and reported alcohol-consumption habits.

2. Material and methods

We used a cross-sectional design and recruited a convenience sample of volunteers across Israel through online advertisements and a panel company. The Ethics Committee of the Faculty of Social Welfare and Health Sciences, University of Haifa approved the study (No. 057-20).

2.1. Sample

Participants were first recruited through online advertisements, social media, and word-of-mouth. To increase sample diversity in ethnicity, age, and educational level, more participants were recruited through the Midgam Project web panel. Midgam, an Israeli company that provides infrastructure for Internet research, has access to over 94,000 panelists in Israel over the age of 17 years. It is one of Israel's largest panels, provides a representative sample of the population, and is highly regarded and extensively used for academic research and political surveys. The single inclusion criterion was that the woman reported being pregnant at the time she completed the survey.

Participation in the survey was voluntary. Women recruited via social media advertisements did not receive compensation. Women recruited via Midgam received, through that platform, a small monetary compensation for their willingness to participate. Interested volunteers signed online consent forms and, regardless of recruitment method, were provided a link to the online questionnaire (Qualtrics^{xm} platform).

2.2. Measures

To avoid possible selection bias, the three-part research questionnaire was published in Hebrew and Arabic. Because the survey was online, anonymous, and developed to be answered by women who varied in age, educational level, religion, and other sociodemographic characteristics, it was designed to be completed quickly (10–15 min) and adequately comprehensible for self-reporting.

2.2.1. Part A: sociodemographic measures

The online questionnaire's first part contained items regarding sociodemographic measures (age, education level, number of previous births, country of birth, and religion/religiosity), gestational week, clinics (public or private) attended for follow-up during pregnancy, and whether a medical professional defined this pregnancy as high risk (yes/no).

2.2.2. Part B: behavioral measures

The questionnaire's second part comprised questions regarding alcohol consumption before and during pregnancy. Participants were asked how often they regularly consumed alcohol in the periods (a) 2

months before recognition and (b) from recognition of the current pregnancy until the time of answering the survey. Responses could range from *never* to *more than once a week*. The survey then asked those who marked that they consumed alcohol regularly to record the amount of alcohol on each occasion (an open question, with an instruction to write any quantity ranging from a very small quantity, half glass, one glass, or more). Further, based on Senecky et al.'s (2011) study, this part asked about respondents' acquaintance with other women who drank alcohol during pregnancy.

Participants were also asked two questions regarding information sources. For the first question, whether participants had received any guidance regarding alcohol consumption during pregnancy, respondents marked 1 (*no*), 2 (*yes, from: public physician, private physician, or nurse*), or 3 (*if yes, fill in other resource*). The second question asked respondents to indicate the most meaningful and helpful sources from which to obtain information on topics related to drinking alcohol, smoking, and other risky behaviors during pregnancy. Possible responses included *physician*, *nurse*, *social networks*, *Internet sources*, *friends or family members*, and *others*. More than one answer could be marked.

2.2.3. Part C: knowledge survey

For this study, we developed a survey to assess participants' knowledge regarding the risks of alcohol consumption during pregnancy and FASD. The survey was based on three questionnaires previously used to explore knowledge, attitudes, and behaviors related to FASD across groups of professionals and health care providers (Johnson et al., 2010; Landgraf et al., 2018; Payne et al., 2011) but adapted in content and wording for women without professional (medical) knowledge. Participants rated how much they agreed with each statement on a Likert scale from 1 (*absolutely agree*) to 5 (*absolutely disagree*). This part contained 26 items, of which 19 assessed knowledge of the effects of alcohol consumption. Three original items were excluded because they had low internal consistency with the others. Thus, the final questionnaire (Appendix A) contained 16 items to measure knowledge; reliability was good (α = .724). The remaining seven items assessed knowledge about other habits (nutrition, smoking, and sports) during pregnancy and were not included in the calculation of alcohol-consumption knowledge levels. Ten questions worded in the opposite direction were reversed before analysis. In the final scale, higher ratings indicated more knowledge.

2.3. Data analysis

We analyzed data using SPSS software version 25. Descriptive statistics for sociodemographic characteristics and knowledge levels were computed using means, standard deviations, ranges, and frequencies. Associations between sociodemographic characteristics, alcohol-consumption behavior, and knowledge about risks of consuming alcohol during pregnancy were assessed using chi-square tests for discrete variables, independent sample *t* tests, one-way analysis of variances for continuous and discrete variables, and Spearman correlations for ordinal variables. Post hoc analysis alphas were corrected using Bonferroni correction.

3. Results

From February to June 2020, 1,059 women accessed and started to answer the study questionnaire; the final sample, 802 women (76 % of 1,059), included only those who completed all parts. Table 1 shows participants' demographic characteristics.

3.1. Alcohol consumption

Of the 802 women in the sample, 539 (67.2 %) reported drinking alcohol (in any amount) in the 2 months *prior to* learning they were pregnant, and 96 (12.0 %) *during* their current pregnancy. Almost one-third (32.8 %) reported not consuming alcohol before pregnancy or consuming it only on a holiday or kiddush (meaning "sanctification," a blessing recited over wine to sanctify the Sabbath and Jewish holy days). Among the women who drank alcohol during pregnancy, 63.8 % consumed up to half a glass on each occasion, 33.0 % up to one glass, 2.1 % up to two glasses, and 1.1 % more than two glasses. Overall, 86.6 % of the sample reduced their alcohol consumption after learning of their conception and throughout their pregnancy. Although only 12.0 % claimed they consumed alcohol during pregnancy, 28.1 % (225) reported knowing other pregnant women who had.

Table 1
Participants' Demographic Characteristics (N = 802).

Characteristic	Mean (*SD*)	Range	Frequency (%)
Age (years)	30.76 (4.58)	19–45	
19–25			105 (13.1)
26–34			532 (66.3)
35–45			165 (20.6)
Religion			
Jewish			751 (93.6)
Muslim			19 (2.4)
Christian			22 (2.8)
Other			10 (1.2)
Residence in Israel			
North			191 (23.8)
Center			358 (44.7)
Jerusalem			123 (15.3)
South			130 (16.2)
Marital status			
Single			29 (3.6)
Married			729 (90.9)
Divorced			4 (0.5)
Widow			1 (0.1)
In a relationship			39 (4.8)
Education			
High school			130 (16.2)
Bachelor's degree			427 (53.2)
Master's degree			245 (30.5)
Number of children	1.12 (1.30)	0–13	
0			309 (38.5)
1			253 (31.5)
2			141 (17.6)
3			67 (8.4)
4 or more			32 (4.0)
Gestational week	23.27 (10.52)	5–45	
High-risk pregnancy			
Yes			149 (18.6)
No			653 (81.4)

3.2. Associations between alcohol consumption and sociodemographic characteristics

To assess associations of alcohol consumption in the 2 months before participants realized they were pregnant and during pregnancy with sociodemographic variables, we conducted chi-square tests. The results (Table 2) show relatively low alcohol consumption before pregnancy among women aged 19–25 years ($\chi^2 = 7.62$, $p = .02$). Reported consumption was higher among women in their first pregnancies ($\chi^2 = 1.99$, $p = .01$), with advanced education ($\chi^2 = 3.23$, $p = .001$), ethnically Jewish ($\chi^2 = 1.61$, $p = .001$), and secular ($\chi^2 = 9.89$, $p = .01$). Furthermore, alcohol consumption during pregnancy was relatively low among women without children ($\chi^2 = 4.76$, $p = 0.005$) and among religiously observant Jewish women ($\chi^2 = 1.89$, $p < .01$).

3.3. Information resources

More than one-third (39.5 %) of the sample received no education

Table 2
Reported Alcohol-Consumption Behavior Before and During Pregnancy by Sociodemographic Characteristic (N = 802).

Characteristic	Response	Alcohol consumption before pregnancy (%)	χ^2	*p*	Alcohol consumption during pregnancy (%)	χ^2	*p*
Age (years)			7.62	.020		0.17	.340
19–25	Yes	58 (10.8)			17 (17.7)		
	No	47 (17.7)			88 (12.5)		
26–34	Yes	362 (67.5)			59 (61.5)		
	No	170 (63.9)			473 (67.0)		
35–41	Yes	116 (21.6)			20 (20.8)		
	No	49 (18.4)			145 (20.5)		
Number children			1.99	.010		4.76	.005
0	Yes	240 (44.8)			22 (22.9)		
	No	69 (25.9)			287 (40.7)		
1	Yes	158 (29.5)			32 (33.3)		
	No	95 (35.7)			221 (31.3)		
2	Yes	88 (16.4)			23 (24.0)		
	No	53 (19.9)			118 (16.7)		
3	Yes	35 (6.5)			12 (12.5)		
	No	32 (12.0)			55 (7.8)		
4+	Yes	15 (2.8)			7 (7.3)		
	No	17 (6.4)			25 (3.5)		
Education			3.23	.001		76.0	.69
High school	Yes	72 (13.4)			13 (13.5)		
	No	58 (21.8)			117 (16.6)		
Bachelor's degree	Yes	283 (52.8)			51 (53.1)		
	No	144 (54.1)			376 (53.3)		
Master's degree	Yes	181 (33.8)			32 (33.3)		
	No	64 (24.1)			213 (30.2)		
Religion			1.61	.001		0.79	.150
Jewish	Yes	513 (95.7)			94 (97.9)		
	No	238 (89.5)			657 (93.1)		
Non-Jewish	Yes	23 (4.3)			2 (2.1)		
	No	28 (10.5)			49 (6.9)		
Religious level			9.89	.010		1.89	< .010
Secular	Yes	319 (61.6)			37 (42.5)		
	No	106 (42.2)			388 (56.9)		
Traditional	Yes	87 (16.8)			8 (9.2)		
	No	45 (17.9)			124 (18.2)		
Orthodox	Yes	88 (17.0)			29 (33.3)		
	No	62 (24.7)			121 (17.7)		
Ultra-Orthodox	Yes	24 (4.6)			13 (14.9)		
	No	38 (15.1)			49 (7.2)		

about alcohol consumption during pregnancy; the remainder received recommendations from a public or private physician (37.4 %), nurse (17.2 %), or social media (5.9 %).

3.4. Associations between knowledge and sociodemographic characteristics

Item scores on the knowledge survey ranged from 1.94 to 5.00 (M = 3.60, SD = 0.52). Results showed that the women who consumed alcohol in the 2 months before pregnancy knew less about the risks of such consumption (M = 3.54, SD = 0.52) than did the women who had not consumed alcohol (M = 3.71, SD = 0.49), $t(800)$ = -4.33, $p < .01$. Analyses of associations between knowledge about the risks of alcohol consumption during pregnancy and sociodemographic characteristics revealed a significant negative correlation between the respondents' number of children and their knowledge of the risks ($r = -0.13, p < .01$). That is, women with more children scored lower on knowledge. There was also a difference in the educational-level category, $F(2, 799) = 4.24$, $p = .01$. Specifically, women with high-school educations (M = 3.50, SD = 0.56) knew less than did women with advanced educations (M = 3.66, SD = 0.48, $p_{adjust} = .01$).

4. Discussion

This study aimed to describe current alcohol-consumption behavior and knowledge about its risks among a sample of pregnant women in Israel. Almost two-thirds of participants reported drinking alcohol (in any amount) in the 2 months before learning they were pregnant. This high percentage aligns with worldwide findings regarding high percentages of alcohol consumption among young women (Substance Abuse and Mental Health Services Administration, 2012). In the United States, nearly 50 % of young women drink alcohol; in one study, 20 % reported heavy episodic drinking in the 30 days prior to the study (Marchetta et al., 2012).

According to Corrales-Guitierrez et al. (2020), alcohol consumption prior to pregnancy predicts a high risk of alcohol consumption during pregnancy. This link highlights the importance of promoting healthy lifestyles among women of childbearing age—specifically, among those trying to conceive—by implementing community-level prevention strategies. Furthermore, although alcohol-consumption rates among women may vary due to cultural differences (Lee et al., 2020), women's alcohol use may affect their sexual behavior and has been associated with the risk of unplanned pregnancy (Naimi et al., 2003). Women may continue to consume alcohol during the very early weeks of unplanned pregnancies, before they realize they are pregnant (Kesmodel et al., 2015). Unplanned and unintended pregnancies can be a substantial public health challenge (Owens and Hinshaw, 2020). Nearly half of all pregnancies in the United States in recent years were unintended (Finer and Zolna, 2016). In Israel, the rate of recurrent unintended pregnancies among women serving in the Israeli military was 22.6 % between 2013 and 2015 (Rottenstreich et al., 2018). Findings from studies using the approaches of both birth control and alcohol-consumption prevention suggest that women may be more likely to change their contraceptive behaviors than to reduce their alcohol consumption. Further studies that explore the interaction between these two prevention pathways would be informative (Symons et al., 2018).

When women become aware of their pregnancy, their alcohol-consumption behavior certainly appears to change. Most of our sample reduced their consumption after conception and throughout pregnancy, which is consistent with findings from previous studies (Ishitsuka et al., 2020; McCormack et al., 2017). This finding might indicate that most pregnant women are aware to some extent of the detrimental effects of alcohol on the fetus. Nevertheless, 12 % of our sample reported drinking alcohol during their current pregnancy. This rate is very close to the 14.1 % Senecky et al. (2011) reported 10 years ago in Israel and to the 10 % Popova et al. (2017) estimated as the global prevalence. This result may suggest that other key factors play a role in maternal drinking behavior. For instance, previous research mentioned factors such as social norms, drinking as recreation and social connection, coping with stressors, negative emotions (Watt et al., 2014), and the quantity of alcohol that the expected child's father drinks (May et al., 2014). A socio-ecological perspective for understanding women's drinking behavior is therefore needed.

The estimated rate of drinking during pregnancy might be higher if, as Senecky et al. (2011) did, we consider reports of "another pregnant woman drinking." Our results show the percentage of women who claimed to personally know women who drank alcohol during pregnancy (28.1 %) was more than twice the percentage of women who acknowledged their own drinking (12.0 %). This finding is consistent with what Senecky et al. found and may result from the women's difficulty in admitting they drank alcohol during pregnancy. However, this assumption needs further investigation in future research.

Attitudes towards pregnant women who consume alcohol have changed over the years. Today, women who consume alcohol during pregnancy are often stigmatized (Roozen et al., 2020). According to Bell et al. (2016), one unintended side effect of the increased awareness and lowered social tolerance is feelings of shame among women who had consumed alcohol during pregnancy. Furthermore, studies have shown that guilt feelings can lead women to inaccurately report their drinking patterns for fear of being judged (Bell et al., 2016). In the context of FASD prevention, future research should explore how public-health prevention goals can be met without stigmatizing women who consume alcohol during pregnancy.

The culture, attitude, or other sociodemographic contexts of the society to which the pregnant women belong also can affect their alcohol-drinking habits (Peadon et al., 2011). Our study data indicated that alcohol consumption before pregnancy was greatest among ethnically Jewish women aged 26–34 years, secular women with advanced education, and women in their first pregnancies. According to data published by the Israeli Central Bureau of Statistics (2019), the average age for marriage in Israel among all women is 25.0 years, and among ethnically Jewish women is 25.8 years. The average age of Israeli women at the time they first give birth is 27.8 years; those who give birth at a younger age are usually nonsecular. These data can explain the profile we described of young women who are pregnant but continue the drinking habits characterized by young people. However, alcohol consumption during pregnancy significantly correlated with the number of children and level of religious observance, such that women with four or more children and nonsecular women consumed significantly less alcohol. These results seem predictable because, among traditional and Orthodox Jewish communities (who statistically have more children in the family), it is less common for women to drink alcohol (Senecky et al., 2011).

Among our survey participants, 39.5 % reported they had received no guidance (from any source) related to alcohol consumption during pregnancy. On the one hand, these results provide a modest source for optimism when compared to the findings of 10 years ago, when nearly 75 % of Senecky et al.'s (2011) sample lacked information on this topic. On the other hand, almost 40 % of our sample still had not received proper official information. In both studies, the pregnant women's overall levels of awareness and knowledge on this topic were found to be low. This finding is especially worrying given the relatively high educational levels among our sample participants.

Our results call for a much stronger education effort from public-health services in Israel, specifically those services treating pregnant women, to enhance these women's level of knowledge and awareness of the risks of drinking alcohol during pregnancy. This conclusion is further reinforced by Corrales-Guitierrez et al.'s (2020) recent findings. They suggested a powerful inverse relationship between the percentage of health care professionals who adequately inform pregnant women about the harmful effects of alcohol consumption in pregnancy and alcohol intake during pregnancy.

Previous research mentioned barriers to implementing clinical guidelines for maternal alcohol consumption in prenatal services. Among them were the public-health service providers' lack of confidence or skills to adequately address alcohol consumption with pregnant women (Payne et al., 2014; Wangberg, 2015); their belief that addressing alcohol consumption could have negative consequences, for example, causing the women anxiety and distress (Doi et al., 2014; Wangberg, 2015); the overall lack of resources to provide such care (France et al., 2010); and the clinicians' social influences and behavioral regulation (Doherty et al., 2020). The reasons that so few health care professionals who treat pregnant woman in Israel warn them about the risks of consuming alcohol should be explored in future research.

4.1. Limitations

Several limitations should be acknowledged regarding this research. First, our measures were not based on one theoretical framework for behavior or psychosocial determinant assessment. For instance, because participation was voluntary and online, we kept the questionnaire short. Such restriction in the number of items to include prevented the possibility of differentiating among knowledge domains. That is, to keep the questionnaire short and user friendly, we incorporated only dichotomous measures asking about maternal alcohol consumption. In planning health-promoting programs, however, more details regarding patterns of maternal alcohol consumption may be needed (Roozen et al., 2018). Second, as with other surveys of this type, our sample was a convenience sample; thus, multiple participants might be familiar with the same other pregnant women. Further, the sample was restricted to pregnant women with access to the Internet and willingness to participate. Another limitation is that we did not confirm the respondents' pregnancies. Last, as with any survey, we relied on the participants' sincerity and willingness to provide truthful responses and limit possible recall bias.

4.2. Conclusion

In this study, the percentages of Israeli women who consumed alcohol before and during pregnancy closely mirrors percentages reported worldwide. This result contradicts a wrongful and perhaps comfortable assumption that due to the social and cultural characteristics of the Israeli population—specifically, a relatively high rate of religious-observant Jews and Muslims—this public-health concern is not as relevant in Israel. Most of the pregnant women who consumed alcohol in our study were young, secular Jewish women with advanced education. The high percentage of women who reported drinking alcohol during pregnancy and the knowledge gaps among Israeli women contradict the assumption that many medical professionals in Israel are complying with the Israeli Ministry of Health guidelines.

For prevention and early intervention, knowledge on how alcohol exposure induces fetal damage is urgently needed. Given the risks of PAE and its serious effects on the individuals, families, and society, priority should be given to improving the current pathophysiological understanding of FASD and to developing strategies for preventive management and treatment to reduce or eliminate the harmful effects of alcohol exposure. In such health-promoting programs and treatments, a deep understanding of the factors that might influence women's engagement

would be valuable.

Authors' contributions

LHH and AB served as principal investigators and senior authors; they conceptualized, designed, wrote, and reviewed the current manuscript. YS and AT reviewed the manuscript and provided scientific and clinical advice regarding the issue of FASD in Israel and regarding interpretation of the data. All authors read and approved the final manuscript.

Role of funding source

Partially supported by the Israel Authority for Prevention of Violence, Alcohol and Drug Abuse.

Declaration of Competing Interest

No conflict declared.

Acknowledgements

We would like to thank all participants for completing the survey.

Appendix A

Risks of Alcohol Consumption During Pregnancy and Its Dangers (Translated from the original Hebrew/Arabic to English)
Please read the statements below and choose the answer that best expresses your degree of agreement with each statement:

	Statement	Absolutely agree	Very much agree	Moderately agree	Slightly agree	Absolutely do not agree
1	It is okay for a pregnant woman to drink an alcoholic beverage from time to time.					
2	A person can recover from fetal alcohol syndrome.					
3	Exposure to cocaine in utero is more dangerous to the fetal brain than is exposure to alcohol.					
4	The Israeli Ministry of Health recommends completely avoiding drinking alcohol during pregnancy (including during kiddush, a one-time social event, etc.)					
5	People with fetal alcohol syndrome have brain damage.					
6	Children with fetal alcohol syndrome may have growth retardation.					
7	There is no association between exposure to alcohol in utero and motor delays.					
8	Women who are planning a pregnancy should absolutely avoid alcohol consumption.					
9	A child who was exposed to alcohol in utero may suffer from emotional and social difficulties.					
10	Drinking one alcoholic beverage during pregnancy does not endanger the fetus.					
11	The only cause of fetal alcohol syndrome is the mother's alcohol consumption during pregnancy.					
12	A child who was exposed to alcohol in utero may suffer from attention deficit and learning disabilities.					
13	Drinking alcohol endangers the fetus only in the first and second trimesters of pregnancy.					
14	One in 13 women who drink alcohol during pregnancy will give birth to a child with developmental difficulties.					
15	Any amount of alcohol that a nursing mother drinks may affect the breastfed baby.					
16	"Binge" drinking (four or more drinks in about 2 hours) is more dangerous to the fetus than is daily consumption of one alcoholic beverage.					

References

Anderson, A., Hure, A., Kay-Lambkin, F., Loxton, D., 2014. Women's perceptions of information about alcohol use during pregnancy: a qualitative study. BMC Public Health 14, 1048–1057.
Bell, E., Andrew, G., Di Pietro, N., Chudley, A.E., Reynolds, J.N., Racine, E., 2016. It's a shame! Stigma against fetal alcohol spectrum disorder: examining the ethical implications for public health practices and policies. Public Health Ethics 9, 65–77.
Brown, J.M., Bland, R., Jonsson, E., Greenshaw, A.J., 2019. A brief history of awareness of the link between alcohol and fetal alcohol spectrum disorder. Can. J. Psychiatry 64, 164–168.
Charness, M.E., Riley, E.P., Sowell, E.R., 2016. Drinking during pregnancy and the developing brain: is any amount safe? Trends Cogn. Sci. 20, 80–82.
Corrales-Guitierrez, I., Mendoza, R., Gomez-Baya, D., Leon-Larios, F., 2020. Understanding the relationship between predictors of alcohol consumption in pregnancy: towards effective prevention of FASD. Int. J. Environ. Res. Public Health 17, 1388.
Doherty, E., Kingsland, M., Wiggers, J., Anderson, A.E., Elliott, E.J., Symonds, I., Tully, B., Dray, J., Wolfenden, L., 2020. Barriers to the implementation of clinical guidelines for maternal alcohol consumption in antenatal services: a survey using the theoretical domains framework. Health Promot. J. Aust. 31, 133–139.
Doi, L., Cheyne, H., Jepson, R., 2014. Alcohol brief interventions in Scottish antenatal care: a qualitative study of midwives' attitudes and practices. BMC Pregnancy Childbirth 14, 170.
Ehrhart, F., Roozen, S., Verbeek, J., Koek, G., Kok, G., Van Kranen, H., Evelo, C.T., Curfs, L.M.G., 2019. Review and gap analysis: molecular pathways leading to fetal alcohol spectrum disorders. Mol. Psychiatry 24, 10–17.
Esper, L.H., Furtado, E.F., 2014. Identifying maternal risk factors associated with Fetal Alcohol Spectrum disorders: a systematic review. Eur. Child Adolesc. Psychiatry 23, 877–889.
Finer, L.B., Zolna, M.R., 2016. Declines in unintended pregnancy in the United States, 2008–2011. N. Engl. J. Med. 374, 843–852.
Flak, A.L., Su, S., Bertrand, J., Denny, C.H., Kesmodel, U.S., Cogswell, M.E., 2014. The association of mild, moderate, and binge prenatal alcohol exposure and child neuropsychological outcomes: a meta-analysis. Alcohol. Clin. Exp. Res. 38, 214–226.
France, K., Henley, N., Payne, J., D'Antoine, H., Bartu, A., O'Leary, C., Elliott, E., Bower, C., 2010. Health professionals addressing alcohol use with pregnant women in Western Australia: barriers and strategies for communication. Subst. Use Misuse 45, 1474–1490.
Gahagan, S., Sharpe, T.T., Brimacombe, M., Fry-Johnson, Y., Levine, R., Mengel, M., O'Connor, M., Paley, B., Adubato, S., Brenneman, G., 2006. Pediatricians' knowledge, training, and experience in the care of children with fetal alcohol syndrome. Pediatrics 118, e657–e668.
Green, P.P., McKnight-Eily, L.R., Tan, C.H., Mejia, R., Denny, C.H., 2016. Vital signs: alcohol-exposed pregnancies: United States, 2011–2013. MMWR 65, 91–97.
Hasking, P., Schofield, L., 2015. Examining alcohol consumption with the theory of planned behaviour: do health and alcohol knowledge play a role? Psychol. Health Med. 20, 838–845.

Ishitsuka, K., Hanada-Yamamoto, K., Mezawa, H., Suito-Abe, M., Konishi, M., Ohya, Y., 2020. Determinants of alcohol consumption in women before and after awareness of conception. Matern. Child Health J. 24, 165–176.

Israeli Central Bureau of Statistics, 2019. Israel in Figures: Selected Data from the Statistical Abstract of Israel. https://www.cbs.gov.il/en/publications/Pages/2019/Statistical-Abstract-of-Israel-2019-No-70.aspx. Accessed September 4, 2020.

Israeli Ministry of Health, 2021. Fetal Alcohol Syndrome. https://www.health.gov.il/Subjects/addictions/Alcohol/FETAL_ALCOHOL_SYNDROME/Pages/FETAL_ALCOHOL_SYNDROME.aspx.

Johnson, M.E., Robinson, R.V., Corey, S., Dewane, S.L., Brems, C., Casto, L.D., 2010. Knowledge, attitudes, and behaviors of health, education, and service professionals as related to fetal alcohol spectrum disorders. Int. J. Public Health 55, 627–635.

Kesmodel, U.S., Urbute, A., 2019. Changes in drinking patterns and attitudes toward and knowledge about alcohol consumption during pregnancy in a population of pregnant Danish women. Alcohol. Clin. Exp. Res. 43, 1213–1219.

Kesmodel, U.S., Kjaersgaard, M.I.S., Denny, C.H., Bertrand, J., Skogerbø, Å., Eriksen, H. L., Bay, B., Underbjerg, M., Mortensen, E.L., 2015. The association of pre-pregnancy alcohol drinking with child neuropsychological functioning. BJOG 122, 1728–1738.

Landgraf, M.N., Albers, L., Rahmsdorf, B., Vill, K., Gerstl, L., Lippert, M., Heinen, F., 2018. Fetal alcohol spectrum disorders (FASD): what we know and what we should know; the knowledge of German health professionals and parents. Eur. J. Paediatr. Neurol. 22, 507–515.

Lange, S., Probst, C., Gmel, G., Rehm, J., Burd, L., Popova, S., 2017. Global prevalence of fetal alcohol spectrum disorder among children and youth: a systematic review and meta-analysis. JAMA Pediatr. 171, 948–956.

Lee, Y.J., Kim, J.Y., Lee, D.Y., Park, K.J., Kim, G.H., Kim, J.E., Roh, G.S., Lim, J.Y., Koo, S., Lim, N.K., Park, H.Y., Kim, W.H., 2020. Alcohol consumption before pregnancy causes detrimental fetal development and maternal metabolic disorders. Sci. Rep. 10, 10054.

Mamluk, L., Edwards, H.B., Savovic, J., Leach, V., Jones, T., Moore, T.H.M., Ijaz, S., Lewis, S.T., Donovan, J.L., Lawlor, D., Smith, G.D., Fraser, A., Zuccolo, L., 2017. Low alcohol consumption and pregnancy and childhood outcomes: time to change guidelines indicating apparently "safe" levels of alcohol during pregnancy? A systematic review and meta-analyses. BMJ Open 7, e015410.

Marchetta, C.M., Denny, C.H., Floyd, R.L., Cheal, N.E., Sniezek, J.E., McKnight-Eily, L.R., 2012. Alcohol use and binge drinking among women of childbearing age, United States, 2006–2010. MMWR 61, 534–538.

Mårdby, A.C., Lupattelli, A., Hensing, G., Nordeng, H., 2017. Consumption of alcohol during pregnancy: a multinational European study. Women Birth 30, e207–e213.

May, P.A., Baete, A., Russo, J., Elliott, A.J., Blankenship, J., Kalberg, W.O., Hoyme, H.E., 2014. Prevalence and characteristics of fetal alcohol spectrum disorders. Pediatrics 134, 855–866.

McCormack, C., Hutchinson, D., Burns, L., Wilson, J., Elliott, E., Allsop, S., Najman, J., Jacobs, S., Rossen, L., Olsson, C., Mattick, R., 2017. Prenatal alcohol consumption between conception and recognition of pregnancy. Alcohol. Clin. Exp. Res. 41, 369–378.

Mendoza, R., Morales-Marente, E., Palacios, M.S., Rodríguez-Reinado, C., Corrales-Gutiérrez, I., García-Algar, Ó., 2020. Health advice on alcohol consumption in pregnant women in Seville (Spain). Gac. Sanit. 34, 449–458.

Naimi, T.S., Lipscomb, L.E., Brewer, R.D., Gilbert, B.C., 2003. Binge drinking in the preconception period and the risk of unintended pregnancy: implications for women and their children. Pediatrics 111, 1136–1141.

Oei, J.L., 2020. Alcohol use in pregnancy and its impact on the mother and child. Addiction 115, 2148–2163.

Owens, E.B., Hinshaw, S.P., 2020. Adolescent mediators of unplanned pregnancy among women with and without childhood ADHD. J. Clin. Child Adolesc. Psychol. 49, 229–238.

Payne, J., France, K., Henley, N., D'Antoine, H., Bartu, A., O'Leary, C., Elliott, E., Bower, C., 2011. Changes in health professionals' knowledge, attitudes and practice following provision of educational resources about prevention of prenatal alcohol exposure and fetal alcohol spectrum disorder. Paediatr. Perinat. Epidemiol. 25, 316–327.

Payne, J.M., Watkins, R.E., Jones, H.M., Reibel, T., Mutch, R., Wilkins, A., Whitlock, J., Bower, C., 2014. Midwives' knowledge, attitudes and practice about alcohol exposure and the risk of fetal alcohol spectrum disorder. BMC Pregnancy Childbirth 14, 377.

Peadon, E., Payne, J., Henley, N., D'Antoine, H., Barton, A., O'Leary, C., Bower, C., Elliott, E.J., 2011. Attitudes and behaviour predict women's intention to drink alcohol during pregnancy: the challenge for health professionals. BMC Public Health 11, 584.

Popova, S., Lange, S., Probst, C., Gmel, G., Rehm, J., 2017. Estimation of national, regional, and global prevalence of alcohol use during pregnancy and fetal alcohol syndrome: a systematic review and meta-analysis. Lancet Glob. Health 5, e290–e299.

Roozen, S., Peters, G.J.Y., Kok, G., Townend, D., Nijhuis, J., Koek, G., Curfs, L., 2018. Systematic literature review on which maternal alcohol behaviours are related to fetal alcohol spectrum disorders (FASD). BMJ Open 8, e022578.

Roozen, S., Stutterheim, S.E., Bos, A.E.R., Kok, G., Curfs, L.M.G., 2020. Understanding the social stigma of fetal alcohol spectrum disorders: from theory to interventions. Found. Sci. https://doi.org/10.1007/s10699-020-09676-y.

Rottenstreich, M., Sela, H.Y., Loitner, L., Smorgick, N., Vaknin, Z., 2018. Recurrent unintended pregnancies among young unmarried women serving in the Israeli military. Isr. J. Health Policy Res. 7, 42–47.

Senecky, Y., Weiss, N., Shalev, S.A., Peleg, D., Inbar, D., Chodick, G., Nachum, Z., Bar-Hamburger, R., Shuper, A., 2011. Alcohol consumption during pregnancy among women in Israel. J. Popul. Ther. Clin. Pharmacol. 18, e261–e272.

Substance Abuse and Mental Health Services Administration, 2012. Results from the 2011 National Survey on Drug Use and Health: Summary of National Findings, NSDUH Series H-44, HHS Publication No. (SMA) 12-4713. https://www.samhsa.gov/data/sites/default/files/Revised2k11NSDUHSummNatFindings/RevisedNSDUHSummNatFindings/NSDUHresults2011.htm.

Symons, M., Pedruzzi, R.A., Bruce, K., Milne, E., 2018. A systematic review of prevention interventions to reduce prenatal alcohol exposure and fetal alcohol spectrum disorder in indigenous communities. BMC Public Health 18, 1227.

Tough, S., Clarke, M., Hicks, M., Clarren, S., 2005. Variation in health care provider definitions of moderate consumption of alcohol as related to recommendations regarding alcohol consumption during pregnancy: results from a Canadian survey. Ther. Drug Monit. 27, 290–296.

Tsang, T., Peadon, E., Bower, C., D'Antoine, H., Payne, J., Elliott, E., 2020. Health professionals are the preferred source of information on alcohol use in pregnancy for Australian women: a national survey. JFASRP 3, e1–e11.

Wangberg, S.C., 2015. Norwegian midwives' use of screening for and brief interventions on alcohol use in pregnancy. Sex. Reprod. Healthc. 6, 86–190.

Watt, M.H., Eaton, L.A., Choi, K.W., Velloza, J., Kalichman, S.C., Skinner, D., Sikkema, K. J., 2014. "It's better for me to drink, at least the stress is going away": perspectives on alcohol use during pregnancy among South African women attending drinking establishments. Soc. Sci. Med. 116, 119–125.

World Health Organization, 2014. Guidelines for the Identification and Management of Substance Use and Substance Use Disorders in Pregnancy. WHO, Geneva.