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Alcohol Consumption During Pregnancy and Newborn Outcome: A Study in Brazil[1]

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SILVA, V. A., R. R. LARANJEIRA, M. DOLNIKOFF, H. GRINFELD AND J. MASUR. *Alcohol consumption during pregnancy and newborn outcome: A study in Brazil.* NEUROBEHAV. TOXICOL. TERATOL. 3(2) 169–172, 1981.—Neonates born to mothers of low socioeconomic status were examined to assess the intrauterine effects of alcohol. Mothers' alcohol use during pregnancy ranged from abstention to heavy drinking. The newborns were randomly selected and examined without knowledge of the drinking history of the mothers. Likewise, the mothers' interviewers had no information about the clinical condition of the infants. Anthropometric measures showed the nutritional state of the mothers to be uniformly distributed among those mothers graded from abstainers (grade 0) to heavy drinkers (grade IV). Six of the neonates born to 26 heavy drinkers, four born to 103 mothers graded as I, II and III drinkers and 3 born to 50 abstainers were considered to show signs of prenatal effects of alcohol, characterized by small size (weight and/or height) for gestational age, microcephaly and short palpebral fissures. The number of such infants was significantly greater among the neonates born to heavy drinking mothers.

Alcohol Pregnancy outcome Fetal Alcohol Syndrome

IN 1973, Jones *et al.* [11] described eight children born to alcoholic mothers, all of whom manifested a pattern of abnormalities that was labeled as the Fetal Alcohol Syndrome (FAS). This publication brought to light a virtually unknown study published in 1968 by French researchers who described the same pattern of anomalies in children born to alcoholic mothers [12].

Since the publication by Jones *et al.* [11], much attention has been given to the subject of the possible teratogenic effects of alcohol [6, 7, 16, 17], including studies using animal models [1, 13, 15]. An important question is the possible role of risk factors such as poor nutrition in exacerbating the effect of alcohol [18]. In this respect, it would be important to study a sample where the low socioeconomic status of the mothers assures a considerable degree of homogeneity concerning nutrition, prenatal care during pregnancy, etc. The present report provides such data through a design in which the study sample of neonates were: (a) all born to mothers belonging to a homogeneous low socioeconomic class and (b) were randomly selected prior to interviewing the mother about her alcohol consumption during gestation. This made it possible to have a sample of newborns whose mothers varied from abstainers to heavy drinkers.

METHOD

The subjects were 200 neonates, randomly selected from among those born during an 18-month period, at the "Amparo Maternal." This maternity ward, located in São Paulo, Brazil, serves women of very low socioeconomic status (most of them without welfare support). Random selection of the newborn was accomplished through a system in which 1–2 of the infants delivered in the last 6 hours of each day were examined by one of the investigators with training in pediatrics. Through the code system employed it was also possible to select prematures and stillborns. The newborn examination was performed without any knowledge of maternal history. The children were measured for weight, length, head circumference and size of palpebral fissures, the major areas altered by intrauterine alcohol exposure [8]. A general examination for dysmorphic features related to maternal alcohol consumption was also performed [8]. Prematurity was assessed through the Capurro test [5] and was considered to occur when the gestational age was less than 38 weeks [21].

Ten to twelve hours after a non-surgical delivery or two days after a surgical delivery, a second investigator, who had no information about the clinical condition of the child,

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TABLE 1

PERCENTAGE OF MOTHERS NUTRITIONALLY INADEQUATE ACCORDING TO ANTHROPOMETRIC MEASURES*

Anthropometric measures	Consumption of alcohol 0	I	II	III	IV
Weight/height	26	19	37	33	35
Arm circumference	54	57	57	58	50
Muscle circumference†	41	18	50	22	25

*Subjects were rated "nutritionally inadequate" according to the criteria of Jelliffe [9] who published tables of standard values for adult females for each measurement, and considered subjects with measurements below 90% of the standard values to be "nutritionally inadequate."

†This measure is available for only about 50% of the sample, uniformly distributed among 0–IV.

interviewed the mother. The maternal interview included questions on alcohol, caffeine, nicotine and other drugs used during pregnancy, and on socioeconomic status. Alcohol ingestion was measured by a quantity-frequency-variability index, scored individually for wine, beer and liquor, adapted from the questionnaire of Cahalan and Cisin [3]. This adapted questionnaire has been utilized by us in previous work [14].

The nutritional assessment of the mothers was performed through anthropometric measures; namely, weight for height, arm circumference and muscle circumference. This last parameter was obtained through the formula of Jelliffe [9], $C_2=C_1-\pi S$, where C_2 indicates the muscle circumference, while C_1 and S correspond to the arm circumference and to the triceps skin-fold (subcutaneous fat), respectively. Weight/height, arm circumference and muscle circumference were compared with the standard values provided by Jelliffe [9]. As the mothers were weighed a few hours after delivery, their weight was compared with the standard value plus 5 kg, since it is considered that during pregnancy there is a weight gain of at least 10 kg and that at delivery there is a weight loss of about 5 kg (foetus, placenta and amniotic fluid) [2]. Each interview, including the nutritional assessment, lasted for 45–60 min.

The mothers were graded from 0 (abstainers) to IV (heavy drinkers), according to Cahalan and Cisin [3]. Grade IV indicated an almost daily ingestion of alcohol with five or more drinks at a sitting at least once in a while; or drinking at least weekly with five or more drinks on most occasions.

The newborns were rated according to the presence of: (a) small size for gestational age (weight and/or length $\leq$ third percentile—Harvard Standard [20]); (b) microcephaly (head circumference $\leq$ third percentile) and (c) short palpebral fissues ($\leq$1.9 cm) as adapted from Hanson *et al.* [8]. A neonate with (a) + (b) + (c) was considered to exhibit features suggesting prenatal alcohol effects. In the Hanson study [8], the presence of either multiple dysmorphic features *or* short palpebral fissures were essential to label a neonate with features of FAS. Although we looked for dysmorphic features (low nasal bridge, epicanthic folds, small nails, limitation of joint movement, large hemangiomas, cardiac murmurs and ear anomalies), as described by Hanson *et al.* [8], they were not used to rate the neonates, as no *multiple* dysmorphic alterations were found. Thus, in our work, the presence of short palpebral fissures was considered essential to consider a neonate as having signs suggesting prenatal alcohol effects. When only small size for gestational age and microcephaly were present, the neonates were considered to have no evident alcohol effect. Another difference with the criterion of Hanson *et al.* [8] is that while those authors considered as short palpebral fissures values less than 1.8 cm, our limit was 1.9 cm. This difference derives from the fact that Hanson *et al.* [8] worked with the gestational age of 36 weeks, while we adopted 38 weeks as a limit to prematurity. From the work of Jones *et al.* [10], it can be assumed that 1.8 and 1.9 cm of palpebral fissure corresponds to 36 and 38 weeks of gestational age, respectively.

Twins, stillborns, prematures, and a small percentage of neonates whose examination could not be completed for several reasons were excluded. Thus, from the initial 200 newborns, 179 were rated according to the criteria described above. The distribution of stillborns and prematures according to alcohol consumption by the mothers was also analyzed.

RESULTS

As expected, our sample of mothers was very homogeneous, belonging to a low socioeconomic class with a mean income smaller than the minimum wage of about 60 dollars per month. They were predominantly 20–25 years old and white (although 36% were mulattoes). The median of previous deliveries was two. Modal income and age and median parity were equivalent for all five alcohol groups. As Table 1 indicates, the nutritional state of a large percentage of the mothers can be considered inadequate according to several parameters [9]. The figures in this table indicate the percentage of mothers below the normal standard values presented by Jelliffe [9] for each parameter. While weight adjusted for height is a questionable measure of absolute undernutrition because the standards do not apply to this population, it can still be used as a relative measure of undernutrition across the five alcohol groups as the pre-pregnancy weight was not available. The distribution of the anthropometric measures of the mothers is similar when alcohol consumption during pregnancy is considered (Table 1). The nutritional param-

TABLE 2

CLINICAL CATEGORY OF THE NEONATES ACCORDING TO THE MATERNAL INTAKE OF ALCOHOL DURING PREGNANCY

Clinical category	Grade	Consumption of alcohol 0	I	II	III	IV
	n	50	18	60	25	26
	%	29.5	9	34	13	14.5
Suggested alcohol effect (A)		3 (6%)	2 (11%)	2 (3%)	0 (0%)	6 (23%)*
No evident alcohol effect (B)		7 (14%)	4 (22%)	9 (15%)	4 (16%)	3 (12%)
(C)		40 (80%)	12 (67%)	49 (82%)	21 (84%)	17 (65%)

(A) includes neonates with small size for gestational age, microcephaly and short palpebral fissures, while (B) includes neonates with small size for gestational age and microcephaly but without palpebral fissure alterations. Category (C) includes the remaining infants.

*Statistically significant; Fishers' exact test ($p=0.0045$), Group IV compared to Groups 0–III.

eters of the mothers graded as abstainers (0) to heavy drinkers (IV) were not significantly different according to the chi-square test using 2×5 contingency tables.

The pediatric rating of each neonate resulted in the figures shown in Table 2. It can be seen that 23% of the heavy drinkers delivered children who were considered to have features suggesting prenatal effect of alcohol. This value was significantly different from the other combined grades (Fisher's exact test, $p=0.0045$). The distribution of the children with no evident alcohol effect (Table 2), occurred by chance levels, as no comparison provided significant results. No relationship was observed between alcohol consumption and the number of stillbirths (n=8) or prematures (n=5) (Fisher's exact test), but this could have been due to the small sample sizes.

The usual consumption of coffee in Brazil was reflected in our sample, with the great majority of mothers reporting more than 3 cups per day. According to the Brazilian method of preparing coffee, the caffeine content in each cup is evaluated at around 50 mg. No difference in coffee consumption among the 5 groups (0–IV) was observed. The percentage of mothers who smoked was 54% for groups 0–III and 88% for the heavy drinkers (group IV). This difference is statistically different (chi-square test, $p<0.01$). However, the groups were not statistically different with respect to heavy smoking ($\geq$1 pack cigarettes per day). Groups 0–III contained 27% heavy smokers and group IV contained 31%.

DISCUSSION

The present data show a higher incidence of signs suggesting the intrauterine effects of alcohol in children born to heavy drinkers. The effect of alcohol was observed by taking into account objective measures; namely, weight, height, head circumference and size of palpebral fissures. The fact that *multiple* dysmorphic features were not observed could be due to the fact that the minor anomalies which characterize FAS might not be discerned by a non-specialist [19]. Taking into account the socioeconomic homogeneity of the sample and the comparable nutritional status of the alcohol groups, the results indicate that the intrauterine effects of alcohol might be observed even in the presence of other risk factors such as inadequate nutrition. It could be argued that the nutritional standards provided by Jelliffe [9] are not appropriate to our population as genetic factors should be taken into account. However, adequate local standards are not available, and, as noted by Jelliffe [9], recent works suggest that environmental influences, especially nutrition, are of greater importance than genetic background or other biological factors. It is important to note that the socioeconomic condition of our sample constitutes the rule, rather than the exception, for the Brazilian population [4].

Three basic factors of the design reassure us about the validity of the results. First, the neonates were examined without knowledge of the mothers' drinking history. Second, the mothers' interviewer had no information about the condition of the child, thus eliminating a possible bias in the interview. Finally, we examined neonates born from abstainers to heavy drinkers, thus providing control for other variables.

The correlation between heavy drinking and smoking implies a possible role of nicotine in the results obtained. However, the number of heavy smokers was distributed similarly from the abstainers to the heavy drinkers. Hanson *et al.* [8] also found that neither nicotine nor caffeine were the primary agent related to FAS, although these authors did not preclude the possibility of an interactive effect between these drugs and alcohol.

A point which deserves attention is the difficulty we had in assessing alcohol consumption. The mothers were always very reluctant about their answers. This is easy to understand, not only because women are more reluctant to admit heavy consumption of alcohol than men (at least in Latin American countries), but also because of their precarious socioeconomic condition [14]. They feared not being able to obtain jobs or being dismissed from existing jobs if they reported heavy drinking. Although the interviewer reassured them that we had only research purposes, we felt that this was not sufficient. The alcohol questions were always asked in the middle of the questionnaire and always began: "When you drink, what kind of beverage do you prefer?" This question was followed by examples of the most typical bev-

erages consumed in Brazil. We felt that asking about preferences produced less resistance than the usual question: "Do you drink?" Afterwards other questions to evaluate quantity, frequency and variability were asked. Even so, there is a probability that the number of heavy drinkers detected was an underestimation.

It was our intent, at the beginning of this study, to follow up the children with periodic somatic and mental development assessments. However, this turned out to be impossible for several reasons, the first of which was the difficulty in locating the mothers through the addresses they gave us. Many mothers had moved without leaving a new address, or had originally given false addresses, presumably to avoid possible interference in their lives. Although a few mothers were located, the poor living conditions of the children (living in slums without the minimal sanitary conditions and/or being subject to infectious diseases, undernourishment, etc.) precluded the possibility of an interpretation of the examination. Our experience with this proposed follow-up study showed us the extreme difficulty (or even impossibility) of such a follow-up in underdeveloped countries.

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