

## CONGENITAL MALFORMATIONS' SYNDROME IN CEBU CATTLE IN PERU

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### Introduction

It is very common to blame inheritance as the cause of congenital malformations; however, the majority of defects are caused by environmental factors or by non-inherited chromosomal abnormalities; the latter are mainly developmental accidents. Environmental teratogens act at the time of embryonic implantation or later. Embryonic or fetal cells undergoing active differentiation are more susceptible.---- The most important environmental teratogens are (1): A) Toxic plants; 1- Lupinus spp. 2- Astragalus spp. 3- Conium maculatum, 4- Nicotiana spp. 5- About a dozen of other genus are capable of causing congenital malformations. B) Viruses; 1- Akabane, 2- Other Bunyavirus (Aino, Cache Valley), 3- Blue Tongue, 4- BVD, 5- EEV, and others. C) Physical Factors (e.g. irradiation, temperature). D) Chemicals (e.g. pesticides, anthelmintics). E) Minerals; 1- non-nutrient minerals (e.g. cadmium, lead); 2- nutrient minerals excess or deficiencies (e.g. copper, manganese and zinc deficiencies; excess of selenium). F) Vitamins excess or deficiencies (e.g. vitamin A).

### History

The northern desert coast of Peru is formed by several isolated ecosystems supplied by irrigation or well water in which cattle and goats are raised. In one of these ecosystems (Alto Chira) an outbreak of about 90 cases of malformed calves was observed in 1962 (2) in a Gyr cebu herd native to the region for more than 30 years. Suspecting an inherited factor all bulls were slaughtered and replaced by new bulls from neighbor farms; amazingly no more malformed calves were born (3). A few years later part of the herd of Gyr cows was moved 100 km south from Alto Chira to Hispon 2, a farm located in the center of the Pabur ecosystem. Pabur is an isolated ecosystem with 100 thousand hectare of natural pastures divided into 10 sections supplied by one water well; every section is divided into 4 grazing areas. It holds about 20 000 head of cebu cattle of which 5 600 are cows, and an undetermined amount of goats, organized in 10 enterprises or farms of different sizes. The animals feed on poor natural pastures and occasional supplementation of proteins and minerals. The area is dry with a few rainfalls every 2 to 3 years. In 1967 15 cows calved malformed calves in Hispon 2; these cows were native to Pabur but were run together with the Gyr cows from Alto Chira. The farmer decided to slaughter the whole herd of 200 cows. A new herd was started and has had normal calf crops for over 20 years.

### Case Report

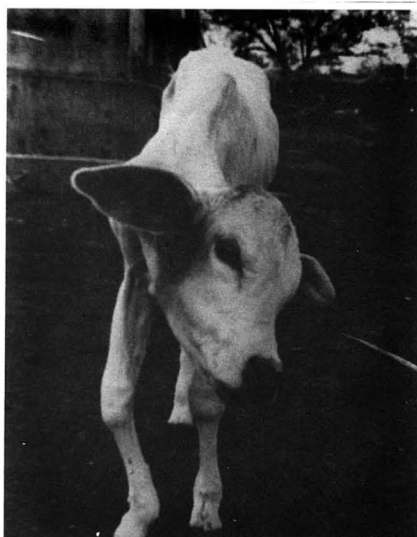
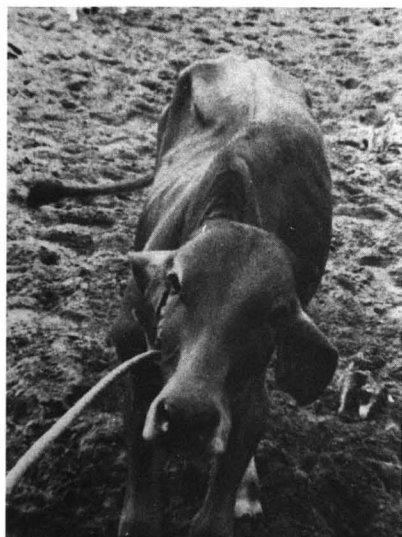
Malformed calves were born in all farms during the calving season from November 1988 to May 1989. Four farms were more severely affected (Table 1). (4) One farm (Hispon 2) was available for continued observation (Table 2). The normal calving crop of 85 to 90% before 1988 dropped to 60% in 1988/89, recovered slightly to 73.6% in 1989/90 and dropped again below 60% in 1990/91. 80% of the malformed calves were born dead mainly due to dystocia. About 35% of the alive born malformed calves survived and had a normal neurological behavior. Some cows calved malformed calves for 2 and 3 consecutive gestations. During 1989 and 1990 about 12% of kids were born malformed from 200 goats that kidded in 3 herds located in Hispon and Potrerillo.

TABLE 1 .- Incidence of malformed calves born in Pabur

Well name	Farm Nº	Nº of cows	Malformed calves		Period observed
			Nº	%	
HISPON	2	200	74	43.8	Nv 88-Sep89
HISPON	1	400	9	3.3	Dc 88-Jan89
HISPON	3	400	5	25.0	Jan89
HISPON	4	160	30	28.0	Jan-Aug89
NEMESIO	1	160	5	55.0	Jan89
NEMESIO	2	800	n.a.	n.a.	
ZAPATA		480	14	n.a.	Dc 88-Jan89
POTRERILLO		500	27	3.6	Dc 88-Jun89
VILLEGAS		500	n.a.	n.a.	
HUALTACO		1 000	10	1.0	Dc 88-Feb89
TERNIQUE		600	n.a.	n.a.	

TABLE 2 .- Incidence of malformed calves born in Hispon 2 (Pabur)

Nº Of Calves born	Malformed calves		Period	
	Nº	%		
31	12	38.7	Oct-Dec	88
25	18	72.0	Jan-Mar	89
44	31	70.4	Apr-Jun	89
25	10	40.0	Jul-Sep	89
55	0	0.0	Oct-Dec	89
70	0	0.0	Jan-Mar	90
51	17	33.0	Apr-Jun	90
38	12	31.6	Jul-Sep	90
60	11	18.3	Oct-Dec	90
33	09	27.3	Jan-Mar	91



The malformations observed in calves were torticollis, escoliosis and arthrogyriposis. Neither palatoschisis, mandibular or eye abnormality suggestive of *Lupinus* spp. toxicity, BVD or vitamin A deficiency, among others, was observed; nor porencephalia, hydranencephalia or cerebellar hypoplasia, suggestive of Akabane, Cache Valley, Blue Tongue BVD and other viral infections, were noted. Besides brain perivascular hemorrhage and vasculitis with infiltration of lymphocytes and macrophages, several other microscopic lesions were observed (demyelination, malacia, satellitosis and neuronophagia); however the unskilled manipulation of fetal brains might have caused them. A search for the presence of toxic plants like *Lupinus* spp. was negative. The possible role of teratogenic viruses was investigated serologically. Over 200 sera were studied at our laboratory, and part of them at Plume Island. The results were negative for Akabane, Ibaraki, EHD, Maguari and Blue Tongue viruses; 13% of the animals were positive to the Cache Valley Virus subtype Playas, but they did not correlate well with the epidemiology of the problem. IBR and BVD are prevalent in the area but they do not seem to be related to the Pabur malformations syndrome. It is interesting that a large amount of the tested sera were positive to EEV (95%) and to strain 1600 of EEV (74%) which is closely related to the VEEV vaccine strain TC-83 (table 3). A virus related to the above mentioned strain was isolated from a malformed fetus recovered from a slaughtered cow from Hispon 2 (5). Four liver samples from different animals showed normal values for lead and manganese (table 4).

TABLE 3.- Serological survey in different species in Hispon 2 (Pabur).

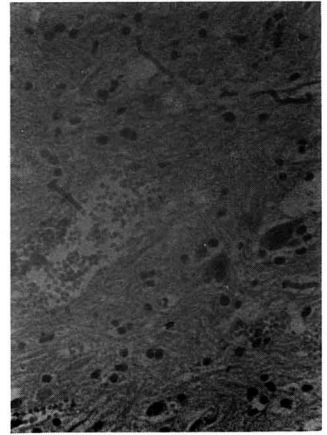
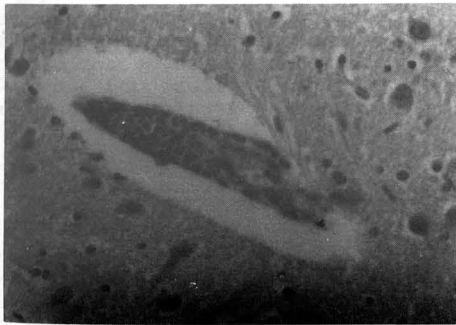
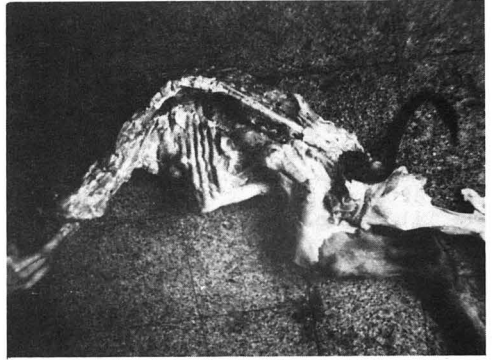
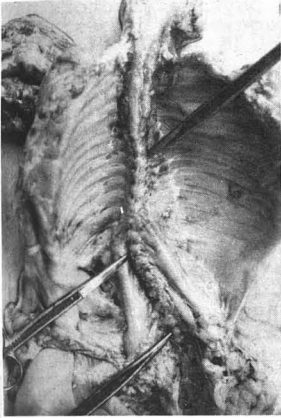
Species	Sera No	Percentage of positive sera (1)									
		AKA	CVV	BT	BVD	IBR	IBA	EHD	MAG	EEV	BAC 1600
B.fetus	3*	0	0	0	-	-	0	0	0	0	-
Calves	3*	0	33.3	0	-	-	0	0	-	-	-
Cows	11*	0	54.5	0	-	-	0	0	-	-	-
Cows	27*	0	0	25.9	-	-	0	14.8	3.7	0	-
Cows	124	-	-	0	65.3	89.5	-	-	-	-	-
Cows	186	-	13.4	-	-	-	-	-	-	-	-
Cows	203	-	-	-	-	-	-	-	95.0	-	74.0
Goats	5*	0	0	0	-	-	0	60.0	0	-	-
Goats	20	-	0	0	0	65.0	-	-	-	-	-
Sheep	9*	0	11.1	0	-	-	11.1	11.1	44.4	0	-
Sheep	24	-	0	0	0	0	-	-	-	-	-
Sheep	73	-	-	-	-	-	-	-	-	70.0	66.0

(1) AKA= Akabane, CVV= Cache Valley Virus, BT= Blue Tongue, BVD= Bovine Viral Diarrhea, IBR= Infectious Bovine Rhinotr., IBA= Ibaraki, EHD= Epizootic Hemorrhagic Disease, MAG= Maguari, EEV= Equine Encephalomyelitis Virus BAC= EEV- Strain 1600

\* Done at Plume Island

TABLE 4.- Lead and Manganese concentrations in cattle livers (Pabur)

Sample No	Lead (mg/kg)	Manganese (mg/kg)
1	1.11	1.84
2	1.18	1.60
3	1.48	2.73
4	1.19	1.97



### Conclusions

This report is unusual because it registers 174 calves born malformed in less than one year in an area of 1000 km<sup>2</sup>. In one farm with 200-300 cows 120 calves were born malformed during a period of 2½ years. A reduction in the total calf crop was also observed and was probably related to embryonic death. The epidemiological pattern of this outbreak allows us to disregard inheritance as the cause. In many aspects it follows the pattern of a viral infection; an immune response of the population was apparent because the cases declined after 9 months of the onset and were not seen during the following 6 months and at the same time the calf crop partially recovered; however the problem reappeared from March 1990 through all 1991 following the same pattern observed during the calving season 1988/89. The importance of the presence of a virus from the VEE complex in this herd has not been established. It is very difficult to find any correlation between the problem and the possible action of other tetatogens like toxic plants, nutritional excess or deficiencies or chemicals. The

possible role of non-nutrient minerals or of physical factors have not been investigated. Further research is required to establish the cause of this disease syndrome.

#### References

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#### Summary (English).

A new disease syndrome has been observed in range cebu cattle in an isolated ecosystem in Peru involving 10 farms with 5600 cows. The syndrome is characterized by a reduction in the total annual calf crop and a high percentage of calves born with severe malformations (torticollis, scoliosis and arthrogryposis). Inheritance and Lupinus toxicity were disregarded as well as the main viral teratogens (Akabane, Blue Tongue, BVD and others). A virus from the VEE complex was isolated from a malformed fetus, however its relationship to the disease has not been established.

#### Zusammenfassung (German).

Ein neues Krankheitssyndrom wurde bei Ceburindern in 10 benachbarte Viehstände mit insgesamt 5600 Kühe in Peru beobachtet. Das Syndrom ist durch eine Verminderung der Kälberate und eine hohe Zahl von Missgebildeten geborenen Kälbern gekennzeichnet (Torticollis, Skoliose und Arthrogrypose). Als Ursache wurden Vererbung, Lupinus Vergiftung und die wichtigsten Teratogenviren (Akabane, Blue Tongue, BVD und andere) ausgeschlossen. Von einem missgebildeten Fetus wurde ein Venezuela Pferdeenzephalitis ähnliches Virus isoliert dessen Bedeutung nicht festgestellt werden konnte.

#### Resumen (Spanish).

Se describe una nueva enfermedad observada en ganado cebu en un ecosistema aislado del norte del Peru (Pabur) con un total de 5600 vacas. Se caracteriza por un síndrome en el que se observa una reducción de la tasa de nacimientos y un alto porcentaje de terneros con malformaciones congénitas (tortícolis, escoliosis y artrogriposis). Se descartaron como posibles causas factores genéticos, intoxicación por Lupinus y la acción de los principales virus teratogénicos (Akabane, Lengua Azul, BVD y otros). De un feto malformado se aisló un virus perteneciente al complejo viral de la Encéfalomiелitis equina venezolana cuyo rol en estos casos no ha podido establecerse.