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Biological Bases of the Aggressive Behaviour - Studies on Man

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Abstract

Several recent researchers have shown that aggression increase in man is positively correlated with a decrease in serotonergic tone, as previous researches had shown in non-human primates (increase in intraspecific competition). Neuronal synthesis of serotonin depends on the plasma "trp/Large Neutral Amino Acids" ratio, because of competition made by LNAAs against tryptophan for neuron access, since they use the same carrier to cross the blood-brain barrier. "Trp/LNAAs" ratio value, in turn, tends to be correlated with amino acid composition of the diet: so a low "trp/LNAAs" ratio diet lowers brain serotonin synthesis. Among cereals utilised for human feeding, maize has a very low "trp/LNAAs" value, and this may lead to a brain serotonin deficiency. It has been observed that countries above the median in maize consumption have significantly higher homicide rates than countries below the median. Maize was firstly and largely utilised by Native American peoples. Particularly, Aztecs may constitute a reference pattern of serotonin deficiency due to alimentary causes. Neuro-behavioural after-effects of dietary low "trp/LNAAs" values are thinkable for some African or European peoples, today or in the past. We think that a low dietary "trp/LNAAs" value might constitute a favourable background for the setting of fanatical ideologies, and a risk factor towards violence or intolerance on the occasion of conflicts caused by various motives.

Introduction

The neurotransmitter serotonin is synthesized by hydroxilation of tryptophan by the specific enzyme tryptophan hydroxylase and subsequent decarboxylation to 5-Hydroxy-tryptamine (5-HT or serotonin) by the aromatic amino acid decarboxylase. Under physiological conditions, tryptophan hydroxylase is not fully saturated with its substrate, so the 5-HT pathway, at least in brain, can be influenced by substrate availability [1]. Tryptophan is transported across the blood-brain barrier (BBB) by a carrier, which transports also: isoleucine (ile), leucine (leu), phenylalanine (phe), tyrosine (tyr), valine (val), histidine (his) and methionine (met). The competition among these Large Neutral Amino Acids is observable and calculable at BBB level, so the effects of each dietary protein on the plasma amino acid pattern tend to be correlated with its own amino acid composition.
Brain trp levels rise when blood trp levels rise or blood levels of one or more of the other LNAA competitors fall [1].

Behavioural consequences of serotonin deficiency

Aggressive behaviour: in rats, serotonin deficiency may be caused by maize-based alimentation; in previous works we have experimentally found that maize nourished rats became mouse-killers, and that they were serotonin deficient rats [2].
Increase of intraspecific competition or intraspecific aggression: several researchers have shown that an increase in intraspecific competition is positively correlated with a decrease in serotonergic tone, in non-human primates or in man. *Temporal lobe epilepsy*. This is linked with the reduction of serotonergic tone, and causes feelings as *dejà-vu*, cosmic visions, and dreaming states. *Attraction for fire*. Low serotonergic tone has been observed in arsonists.
Among cereals utilised for human feeding, *maize has a very low "trp/LNAAs" value*, and this may lead to a brain serotonin deficiency. *Maize was firstly and largely utilised by Native American peoples*. Among them, the above-mentioned behavioural consequences appear, as a rule, positively correlated with maize alimentary dependence. Particularly, *Aztecs may constitute a reference pattern of serotonin deficiency* due to alimentary causes.
In 1977 Harner [3] proposed that Aztecs practised cannibalism to obtain proteins containing all amino acids. In fact: a) Aztecs lacked herbivorous animals as protein source. Ancient hunters had completely liquidate big herbivores in the Mesoameriean area, and hunting small game couldn't meet growing population's needs, and b) Yearly, they made wars to capture prisoners for sacrifices.
Ortiz de Montellano [3] objected that they could obtain all amino acids from vegetable foods. But it has been observed that Aztec main food, maize, was lacking in lysine and

tryptophan. Other foods, e. g. beans, could supply further amounts of trp and of other amino acids, but serotonin deficiency might continue to exist because of competition of other LNAAs against tryptophan for neuron access, as it has been described in introduction. Table I shows amino acid composition of some Aztec foods and of other foods that were not available for the Aztecs, and trp/LNAAs ratios, both in absolute values and in carrier-affinity related values (stating "trp 1/Km"= 1).

When maize was the preponderant food in the meal, the value of R tended towards that of maize. After its harvest, maize presumably became the main dietary food, consequently reduction of trp/LNAAs ratio, and of 5-HT synthesis, occurred. The facts that (see table II) all the cannibalistic rites were made after maize harvest, and maize-human flesh raises trp/LNAAs ratio value, suggest the hypothesis that cannibalism might be helpful to promote 5-HT synthesis. It is also in accordance with cannibalism's lack when amaranth dishes were eaten, since amaranth has a high tryptophan content and high trp/LNAAs ratio value. We think that a low "trp/LNAA" value from diet based on maize, or other foods with low "R", might constitute a risk factor towards violence or intolerance on the occasion of conflicts caused by various motives.

	$\frac{K_m^W}{K_m}$ LNAAhuman	Maize	Beans	Amaranth	Human muscle	Beef	Pork
Trp	1	2.451	5.293	6.863	6.4	6.462	6.907
Ile	1.111	32.061	53.399	27.481	39	43.372	44.066
Leu	0.909	93.130	80.995	38.931	61	67.661	66.621
Phe	10	22.424	39.835	36.364	27.5	29.201	26.997
Tyr	2.308	20.994	25.160	(F+Y)[a]	19	22.350	22.853
Val	0.341	38.461	65.407	35.897	47	51.282	55.167
Met	0.588	12.752	8.193		18	19.829	21.964
His	0.588	17.419	21.203		[29][a]	24.926	29.032
					a: as pork		
Rr (x 1000)		10.33	17.99		26.49	24.99	25.90
Rn (x 1000)		5.78	8.41		13.81	13.31	14.36
Rn (x 1000)(25% Phe)		**8.32**	**13.26**		**21.05**	**19.66**	**21.23**

Table 1. Aminoacidic composition and Trp/LNAAs ratios

Aztec month	Christian Calendar Agricultural cycle		Ritual ceremonies
1 Atlcaualo	02/14 to 03/05		*Children sacrificed to Tlaloc.*
2 Tlacaxipehualiztli	03/06 to 03/25		*Big kill. Children to Tlaloc.*
3 Tozozoztontli	03/26 to 04/14		*Children to Tlaloc.*
***4* Hueytozoztli**	04/15 to 05/04	***Rainy season***	
5 Toxcatl	05/05 to 05/24	**Planting of**	Eating of victims possible
6 **Etzalcualiztli**	05/25 to 06/13	**Corn**	but not mentioned.
7 Tecuilhuitontli	06/14 to 07/03		
8 Hueytecuilhuitl	07/04 to 07/23		*Time of scarcity*
9 Miccailhuitl	07/24 to 08/12		
10 **Xocotlhuetzi**	08/13 to 09/01	*Fruit harvest*	No killing, no victims eaten.
11 Ochpaniztli	09/02 to 09/21		Harvest feast.
12 **Teotleco**	09/22 to 10/11		
13 Tepeilhuitl	10/12 to 10/31	**Corn**	**Big kill and eating.**
14 Quecholli	11/01 to 11/20	**Harvest**	**Large wild game hunt,**
		Dry Season	**captives sacrificed and eaten.**
15 Panquetzaliztli	11/12 to 12/10 #	**Corn**	**Biggest kill and eating.**
16 Atemoztli	12/11 to 12/30 #	**Harvest**	No victims eaten;

Aztec month	Christian Calendar Agricultural cycle		Ritual ceremonies
			***Eating of amaranth idols.* #**
17 Tititl	12/31 to 01/19		Eating of victims not mentioned.
18 Izcalli	01/20 to 02/08		No victims eaten;
			Eating of amaranth dishes.#
(Nemontemi)	02/09 to 02/13		

• # Amaranth harvest or eating (Martinez 1936, see 3).

Aztec months 1, 2, 3 and 4: ***from medium to low corn availability.***

Aztec months 5, 6, 7, 8, 9, 10, 11 and 12: from low to very low corn availability**.**

Aztec months 13, 14, and 15: **hign corn availability.**

Aztec months 16, 17, and 18: high corn availability, but eating of amaranth.

Table 2. Aztec Calendar, agricultural cycle and ritual ceremonies (see 3)

Key words

Aggressive behaviour, serotonin, testosterone.

References

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