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ON FEATHER PICKING
AND CANNIBALISM IN PHEASANT
AND PARTRIDGE CHICKS, PARTICULARLY IN
RELATION TO THE AMINO ACID ARGININE

By

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In 1963 the good news that arginine can prevent cannibalism in cockerels and pheasants reached even the Danish television via papers by *Sirén* (1963a, b). Since feather picking etc. (by *Sirén* and most other authors comprised in the concept “cannibalism”) is quite a problem in rearing of pheasants and in later years also of partridges in Denmark, it was decided to investigate the matter, because *Sirén's* material consisted of only twenty pheasants. The results appeared, however, clear-cut to such a degree that it was felt worth while to take a closer view at the arginine problem. Concurrently, some related problems were taken up.

MATERIAL AND METHODS

A number of experiments were conducted in the summer of 1964 at the pheasant breeding farms at Kalø (in Jutland) (Vildtbiologisk Station), Freerslev Hegn and Svenstrup, Borup, both in Zealand; finally, experiments with partridge chicks were run at the Fromsejer Partridge Breeding Farm, Vorbasse, Jutland. During work on sexing day-old pheasant chicks started in 1963 (see *Madsen* 1966), it looked as if keeping the sexes apart may influence the feather picking. In each pheasant chick experiment four groups were accordingly established, treated and untreated female and male groups, almost 950 birds having been under

Table 1. Numbers of animals in experimental groups.

Exp. no. Species	1. Kalø Pheasant	2. Freerslev Hegn Pheasant	3. Vorbasse Partridge	4. Svenstrup Pheasant	5. Kalø Pheasant	6. Kalø Pheasant
1st weighing (age in days)	Aug. 10, 1964 (35)	June 24, 1964 (20)	—	Aug. 7, 1964 (24)	June 23 (11)	Sept. 9 (75)
2nd weighing (age in days)	Aug. 21, 1964 (46)	Aug. 5, 1964 (42)	—	Aug. 25, 1964 (42)	Aug. 11 (60)	Sept. 25 (91)
Treatment	arginine	arginine	arginine	smelagenine	none	none
♂ treated	31	136		36	—	—
♀ "	28	130	77	37	—	—
♂ untreated	31	131	96	30	—	—
♀ "	22	118		39	—	—
Total	112	515	173	142	83	56
No. of chicks (kg)/m ²						
1st weighing	12.2 (2.65)	14.3 (1.82)		3.1 (0.75)	—	—
2nd weighing	11.9 (3.84)	3.1 (1.74)		2.9 (1.24)	2.3 (1.07)	2.1 (1.33)

Table 2. Content of crude protein and amino acids in feeds.
(Analyses by Bjørn O. Eggum, Landøkonomisk Forsøgslaboratorium,
Dyrefysiologisk Afdeling).

	Pheasant feed	Partridge feed
	g amino acids/16 g N or 100 g crude protein	
Cystine	1.19	1.62
Asparagine	9.82	8.25
Methionine	1.88	1.98
Treonine	4.50	3.56
Serine	5.09	4.64
Glutamic acid	20.79	21.74
Glycine	4.78	4.11
Alanine	4.96	5.84
Valine	5.04	5.11
Isoleucine	4.79	4.53
Leucine	7.67	9.64
Tyrosine	3.06	3.03
Phenylalanine	4.89	4.79
Lysine	5.82	4.04
Histidine	2.62	2.57
Arginine	5.06	4.76
% N	4.33	2.67
% crude protein	27.06	16.69

observation. Besides these chicks observations in regard of feather picking etc. were made on chicks which were used in trials of drugs against syngamosis (Gapes), almost 150 birds in all. During the planning of the experiments my attention was turned to a saponine, isosarsapogenine ($C_{27}H_{44}O_3$) (smelagenine®). It was claimed to improve feathering and might therefore be supposed also to influence on feather picking. Accordingly, the substance was used in exp. 4.

The main features of the experiments are presented in Table 1.

In exp. 1 the chicks were kept indoors, on wire netting. In exp. 2 they were also indoors to start with, but by and by getting access to outdoor cages. In exp. 4 the chicks were in outdoor cages, each connected with a house in which heating elements were installed. In the exps. 5—6 the chicks were in outdoor flight cages, being old enough to do without heating. As will appear from the various tables no specific conditions at the various farms could be correlated with the great differences found between them.

The content of protein and amino acids of the feeds used in the experiment is given in Table 2. In order to reach the level of arginine, indicated by *Sirén* (1963b) as prohibiting or stopping feather picking and cannibalism, viz. 6.9 pct. of the protein, the partridge basal diet was enriched with 3,57 g arginine or 4.31 g argininehydrochloride per kg feed. The corresponding figures for the pheasant feed was 4.97 g and 6.01 g, respectively.

The degree of feather picking and cannibalism (which latter in some experiments occurred as "bloody cloaca") was registered, in some cases early in the experiment, but at any rate when finishing it, the chicks being weighed the second time.

The following regions were discerned: Back, divided in 1) fore-back, 2) hindback and 3) upper tail coverts, in each case classified from zero, if no sign of picking was seen, to four, if no feathers were left. In the case of the wings the classification was a little more arbitrary in the upper reaches, because no bare wings were seen.

Also the picking of the tail feathers was classified from zero to four. By pure inspection of my primary figures it was evident that the pattern followed by these figures was completely independent of that of the back scores, as will be seen from the tables. The back scores were added for some purposes, whereas the tail picking scores were kept and treated separately.

Besides the records just mentioned it was also noted, if the cloacal region had been picked to a degree of being bloody or not. This latter characteristic was found to any appreciable extent only in exps. 2 and 5. Furthermore, the presence of wounds was recorded. They were found on the wings in exp. 1 and on the tail in exp. 4.

RESULTS

From Table 3 it appears that *the treatment with arginine had not the slightest influence on the degree of picking* of the feathers of back and wings or of tail feathers. Further, the treatment had no influence in exp. 2, in which cannibalism (picking of the cloaca) occurred.

As an example let us look more closely at the fourth column of Table 3, exp. 2, in which experiment the highest number of chicks was used. We find in treated chicks 54 % with a high degree of back-feather picking, in the untreated group 32 %. These figures are different with a high degree of significance

Table 3. Percentage of chicks with various characteristics (n: see Table 1).

Column no.	Exp. 1				Exp. 2				Exp. 4				Exp. 3 a		Exp. 3 b	
	Pheasant chicks		Pheasant chicks		Pheasant chicks		Pheasant chicks		Pheasant chicks		Pheasant chicks		Partridge chicks		Partridge chicks	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14		
	% chicks with back I1 picking scores ≤ 11	% chicks with tail feathers picked	% weight gain	% chicks with back I2 picking scores ≤ 12	% chicks with tail feathers picked	% chicks with bloody cloaca	% weight gain	% chicks with back picking	% chicks with tail feathers picked	% weight gain	% chicks with heavy back picking	% chicks with tail feathers picked	% chicks with heavy back picking	% chicks with tail feathers picked		
♂ ♂	treated	87.1	64.5	59.7	53.7	94.8	8.8	374.7	100.0	58.3	88.7	82.4	74.5	92.3	92.3	92.3
	untreated	90.3	45.2	45.0	32.0	95.5	33.5	358.6	83.3	90.0	83.2	(n=51)	(n=26)	treated		
♀ ♀	treated	7.1	39.3	50.7	23.0	92.4	30.8	316.4	16.2	43.2	80.2	**	55.1	76.8	81.5	96.3
	untreated	18.2	90.9	36.2	11.2	95.0	45.7	305.4	23.1	56.4	77.3	*	(n=69)	(n=27)	untreated	

Asterisks indicate levels of significance of differences (Chi-square tests; in the case of percentage of weight gain: t-test).

Table 4. Percentage of chicks with heavy tail feather picking (4 scores).

		Exp. 1		Exp. 2		Exp. 3 a		Exp. 4		Exp. 5		Exp. 6	
		n	%	n	%	n	%	n	%	n	%	n	%
Back-	heavy	60	33.3	271	69.9	80	86.3	35	45.6	35	68.6	15	73.3
	picking						***				***		
Upper tail coverts picked	weak	52	25.0	244	71.4	40	55.0	107	39.3	48	18.8	41	78.0
	4 scores	78	30.8	220	65.5	—	—	35	45.0	47	51.1	11	72.9
	< 4 scores	34	29.4	295	71.5	—	—	107	37.5	36	25.0	45	77.8

Asterisks: see Table 3.

(Chi-square test), but I think that everybody will agree that we cannot conclude that feeding with arginine promotes feather picking, even though we find, in the case of the females, a similar tendency; with 23 %, a high degree of feather picking in treated chicks, and “only” 11 % in untreated birds (also this difference is significant). A glance at the corresponding columns for exps. 1 and 3 makes that sufficiently clear. Also in the case of smelagenine no influence on feather picking was found.

However, arginine actually had an influence on the animals, since treated chicks gained, mostly significantly, more than the untreated birds, whereas smelagenine did not influence the weight gain (Table 3, columns 3, 7 and 10).

As mentioned already, there is no evidence, in spite of partly significant differences between groups, that arginine does influence the picking of the tail feathers; but it is evident that this kind of picking follows a pattern of its own; again independent of this pattern is that of cannibalism in its restricted sense (“bloody cloaca”) (Table 3, columns 2, 5, 9, 12, 14, and 6).

In Table 4 data are presented, demonstrating that in most cases the habit of picking the tail feathers goes on independently of the picking of the back, even independently of the picking of the upper tail coverts. The only exceptions were in exp. 3, the partridge chicks, and the pheasant chicks in exp. 5, comprising a group of 83 birds. In all the other pheasant chicks (825 birds) no evidence was found that the two kinds of picking influenced each other. In a similar way it was not possible to demonstrate that the picking of the tail feathers had anything to do with the production of a bloody cloaca (Table 6).

Table 5. Mean percentage of weight gain.

		Exp. 2		Exp. 5	
		n		n	
♂♂	+ bloody cloaca	54	336.2 ***	7	978.3
	÷ „ „	194	376.3	43	937.0
♀♀	+ „ „	92	240.4 ***	6	815.3
	÷ „ „	149	314.9	25	814.8

Asterisks: see Table 3.

Table 6. Percentages of chicks with bloody cloaca.

		Exp. 2		Exp. 5	
		n		n	
Tail picked	4 scores	353	30.9	33	9.1
	< 4 scores	162	24.7	50	22.0

The degree of back picking and tail picking did in no case influence the weight gain of the chicks. Only in exp. 2, the one in which cannibalism occurred to any larger extent, the weight gain was adversely affected by the cannibalism, to a highly significant degree (Table 5).

In exp. 5, in which picking of the cloaca also occurred to a slight degree, no interdependency between picking and weight gain could be demonstrated. This suggests that the lower gain of weight in exp. 2 was *caused* by the picking of cloaca. Beforehand, it could not be excluded that the picking of the cloaca had to do with the lower gain in weight. In the case of adult fowls, *Weaver & Bird* (1934) take it as possible that part of the true cannibalism "was induced by the subnormal physical condition of the killed subjects".

In addition to the picking of cloaca occurring in exps. 2 and 5, wounds were recorded also in two other experiments. In exp. 1 wounds were found on the wings to the higher degree in the male groups. In accordance with this, it was found that this kind of picking was positively correlated to the degree of back feather picking, to a highly significant degree (Table 7). In exp. 4 wounds were only found on the tail. A tendency of more wounds to occur when picking scores were high was found, but the difference was

Table 7. Percentage of chicks with wounds.

	Exp. 1		
	Scores	n	
Back picking (with- out wing scores)	≥ 11	43	23.2 **
	< 11	69	4.4
Wing	≥ 4	28	42.8 ***
	< 4	84	1.2
	Exp. 4		
Tail	4	58	27.6
	< 4	84	15.5
	♂♂	66	33.0 *
	♀♀	76	11.8

Asterisks: see Table 3.

not significant. That the tendency may nevertheless represent a reality is suggested by the fact that the occurrence of wounds appears significantly dependent upon the separation of the sexes of the chicks (see below).

In any case, these findings do not support the common contention that cannibalism represents a higher degree or a continuation of feather picking, since the wounds in each case were restricted to a certain body region, and nothing like this was found in exp. 2 and exp. 5, the only experiments in which the cloaca was picked. This latter phenomenon had no relationship whatsoever to any kind of feather picking. Naturally, the real cannibalism must start from picking the cloacal region and has been found in its highest severity in laying poults.

It was not possible to see any dependency of the phenomena studied here and the number of chicks per area unit (see Table 1).

Summarizing, it may be said that a number of consistent phenomena have been demonstrated in the experiments. Very often significant differences, independent of any intentioned treatment occur between groups, both in pheasant and partridge chicks.

The "cannibalism" as observed by many, including recent, authors can be seen to consist of at least three, mainly independent phenomena, back picking, tail feather picking, and "cannibalism" in a restricted sense. It was not recorded to what extent

feather *eating* followed feather picking; this should be noted in future experiments.

The only intentioned treatment which appeared to be of any significance was the separating of the sexes of the chicks, since female chicks (also, as in exp. 4, when the sexing was effective only to 80 %, against 95 % in the other experiments) picked the back significantly less than the males. It is one argument more for considering the tail feather picking and the cannibalism as independent phenomena that the sexing had no influence upon them.

DISCUSSION

There is quite a body of papers on the problems of feather picking and cannibalism. Of recent reviews those by *Whittle* (1957—58) and *Sirén* (1963b) may be mentioned. Most of the literature is concerned with domestic chicken. Only a few papers on pheasants are available (*Scott et al.* 1954a, b).

The situation is well described by *Schaible et al.* (1947), and prevails in the main up to the present day: "The vicious habit of picking feathers, combs, wings, toes, tails, vents and other parts of the body is considered one of the serious problems in keeping poultry in confinement. — — The habit is usually attributed to faulty management, overcrowding, overheating, underventilation, humidity, too bright light, insufficient nesting, eating and drinking space, presence of injured or sick birds, the housing together of pullets of different ages etc. — — To a lesser extent the habit is also attributed to rations deficient in certain nutrients or containing too much of others. — — It is assumed — — that feather picking is a prelude to cannibalism. There is not yet sufficient evidence to substantiate these contentions".

Curiously enough there seems to be only a single paper using scores of feather pulling in a similar way as in the present study, viz. that of *Willimon & Morgan* (1953). This system of scoring has been taken over uncritically by *Sirén* (1963b).

Their system of scoring is the following: "(1) No evidence of feather pulling. (2) Indication of pulling tail and back feathers. (3) Some tail, back and body feathers missing — no blood observed. (4) A number of tail, back and body feathers missing — evidence of blood or scabs. (5) A number of tail, back and body feathers missing — small blood spots or scabs. (6) Large area of tail, back and body feathers missing — more extensive blood spots."

In the light of the above reported results, it will be seen that this system of scoring is too arbitrary, and from the start confounds characteristics which ought to be kept apart.

In regard of their experiments, *Willimon & Morgan* write: "With certain pens there was a significant difference in the degree of feather pulling as compared with the control pen, but there was a lack of consistency in the results", or as *Schaible et al.* (1947) put it: "It was recognized at the beginning that one of the most difficult problems in studying cannibalism would be the reproducibility of the results". This is in accord with my own observations and with those of numerous papers concerned with feather picking etc. *Sirén* (1963a, b) does not report difficulties of this kind. Incidentally it may be noticed that pheasant chicks are particularly suitable for this kind of study, because feather picking will turn up in practically any rearing farm.

I can find no explanation for the differences between *Sirén's* and my results, he finding arginine in certain amounts in the feed prohibiting or stopping both kinds of feather picking and cannibalism, and I finding no such things. It must be stressed that *Sirén's* results are also at variance with almost all previous studies, since it has not been possible to demonstrate that any specific substance is responsible for the various phenomena collectively termed cannibalism (see e.g. *Richter* 1954).

Furthermore, considering the clear cut results presented by *Sirén*, it is astonishing that in a considerable number of papers concerned specifically with the need of arginine for chickens, no mention is made of any feather picking or cannibalism, in spite of the careful recording of a number of other characteristics of the experimental chicks (e.g. *Klose et al.* 1938; *Klose & Almquist* 1940; *Leveille & Fisher* 1959; *Snyder et al.* 1956. For further references see *Sirén* 1963b, p. 40—41). *Sirén* was aware of this problem, and disposes of it this way: "Apparently owing to experimental arrangements whose purpose was chiefly to find out the arginine requirement of poultry, spontaneous cases of cannibalism have not occurred, or if they have, no attention has been paid to them".

Minor nutrient minerals do not play any decisive rôle (*Willimon & Morgan*), whereas *Newman* (1935) and *Schaible et al.* found an effect of certain minerals. These latter authors, *Margolf* (1929), *Waibel & Johnson* (1961) and *Turk et al.* (1961) found that less feather picking occurred in birds on a high protein diet than in those on a low protein level.

Whereas *Kull* (1948) in general terms indicated that feather meal had a beneficial influence on feather picking, *Turk et al.* in carefully planned experiments found the addition of feather meal to the diet to be detrimental, and the addition of L-lysine of no effect. On the other hand, *Neal* (1956) found methionine to be effective, in a similar way as *Sirén* did in the case of arginine, whereas *Sherwood* (1958) found neither methionine nor niacine effective. Similarly, *Waibel & Johnson* found no specific effect on feather picking of lysine and methionine, although both substances increased the productivity of the birds.

A number of papers are concerned with the fiber content of the diet (*Bearse et al.* 1940; *Miller & Bearse* 1937, 1938; *Scott et al.* 1954a, b; *Calet* 1965), and a high content of fiber has been found to be beneficial.

A considerable number of papers points out the great rôle in feather picking etc., played by the form in which the feed is given, particularly the pellet-grain-mash complex, in the way that a high degree of grain or pellets predisposes to feather picking and (or) cannibalism (*Knowles* 1939; *Jeffrey* 1944; *Ebbell* 1939; *Heywang & Morgan* 1944; *Bearse et al.* 1949; *Davidson et al.* 1941; *Kennard & Chamberlin* 1944; *Huston et al.* 1956; *Lanson & Smyth* 1955; *McIntyre & Jenkins* 1955; *Skoglund & Palmer* 1961).

As *Calet* points out it is difficult to visualize that pellets or grain in themselves can be the primary cause of picking. *Ziegenhagen et al.* (1947) found that granules, not pellets, tended to promote cannibalism. A number of substances like antibiotics, arsenicals and thyreoactive compounds did not prevent feather picking in pheasant chicks, in spite of improved feathering observed. Iodinated casein contrariwise appeared to accentuate feather picking, perhaps because of the increased metabolic rate. The growth rate increased in all instances (*Scott et al.* 1954b). *Turk et al.* found that high energy levels in the feed tended to produce difficulties from feather eating and feather picking.

Is it altogether possible to bring all this conflicting evidence into harmony?

Considering the experiments presented here, the partly highly significant differences in degree of back picking, tail picking and cannibalism found between groups in the single experiment was very characteristic. This was the case whether or not arginine was given and independently of difference in weight gains. It appears therefore evident that nutritional factors play no rôle in

the causation of these differences. This makes it most improbable that nutritional factors are altogether of importance in the causation of the whole complex of phenomena. Neither within nor between the experiments has it been possible to show that any management factors were active. It would, however, be useful to follow up this matter with future — and strictly controlled — experiments, preferably in units in which the “climate” (relative moisture, temperature, draught etc.) could be controlled.

It is clear that as long as the relative independency of the phenomena, still mostly collectively termed “cannibalism”, was not recognized, conflicting results were bound to arise.

This does not mean that I will maintain that the as yet discerned phenomena of back-wing picking, tail picking and cannibalism in a restricted sense are absolutely independent. In the *groups* I have not found one without the others. Therefore, there *might* be some common predisposing influence.

Another fact emerges from my experiments: In the case of back—wing feather picking behavioural factors are active in some way, since female groups pick less than male groups. When the sexes go together, no differences between them can be ascertained.

The main result of previous studies on feather picking etc. that the way in which the feed is dispensed is partly responsible for the phenomenon does not contradict the contention that behavioural factors lie at the root of the matter. There may be something which does not satisfy the instincts of the birds. One aspect may be that when the feed is pelleted it is consumed more quickly, thus giving more time for other occupations, among which feather picking may be one. The finding by *Voss* (1933) that staining with methylene blue of the chicks could stop feather picking and cannibalism also points to some behavioural trigger, as does the finding by *Marsboon & Sierens* (1962) that a sedative caused a decrease of cannibalism.

It has been established (see i.a. *Sanctuary* 1934; *Richter*) that feather picking and cannibalism also involve some genetic factors, again a fact which by no means excludes the dependency of these phenomena upon behavioural traits.

It is a curious fact that nobody as yet seems to have tried to correlate peck order with picking, although *Sanctuary* in general terms states that: “Negatively speaking there is apparently little or no relationship between cannibalism and bossism”.

To clarify this whole complex matter in greater detail it

will be necessary to design experiments in cooperation with an ethologist. *Wood-Gush* (1956) puts it this way: "Social malpractices such as cannibalism and feather pecking are also good subjects for the behaviourist. As yet nothing is known about the stimuli that initiate outbreaks of either of these; indeed, it is uncertain whether cannibalism usually develops from feather pecking or whether the basis of either trouble lies in environmental factors such as nutritive requirements or extreme climatic conditions". Some of these questions have been elucidated in the present paper. The problem is complicated in the case of pheasant and partridge chicks, since nothing at all of their social behaviour is known opposed to the fairly large literature about that of the domestic chicken (see *Wood-Gush* 1955, 1956; *Guhl* 1964).

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SUMMARY

- 1) In the case of pheasant chicks in particular it could be demonstrated that what is most commonly collectively termed degrees of "cannibalism", picking of the back and wings, picking of the tail feathers, and picking of the cloaca (cannibalism in its restricted sense) are three, in the main, independent phenomena.
- 2) At variance with results published by *Sirén* (1963a, b) no evidence was found in the experiments reported here that the amino acid arginine in any way influences the above mentioned phenomena. In fact, there was no evidence whatsoever indicating that nutritional factors play a rôle in any of the differences found.
- 3) As far as the feather picking of back and wings (even to the degree that wounds were found) is concerned, behavioural factors are evidently active, since in sexed groups, the female batches picked significantly less than the male ones. The picking of tail and cloaca was not influenced by this measure. Back picking and tail feather picking did not influence the weight gain of the chicks, whereas picking of the cloaca, when occurring to any extent, significantly depressed weight gain.

ZUSAMMENFASSUNG

Federpicken und Kannibalismus bei Fasanen- und Rephuhnküken besonders mit Bezug auf die Aminosäure Arginin.

- 1) Bei Fasanen- und Rephuhnküken konnte es gezeigt werden, dass was im Allgemeinen „Kannibalismus“ genannt wird, dieses dass die Küken die Federn vom Rücken, von den Flügeln und vom Schwanz abzupfen, und dass sie die Kloake hacken (Kannibalismus im eingeschränkten Sinne) drei verschiedene, im wesentlichen voneinander unabhängige Phänomene sind.
- 2) Im Gegensatz zu den Resultaten, von *Sirén* (1963 a, b) publiziert, waren in den hier wiedergegebenen Experimenten keine Anhaltspunkte dafür, dass die Aminosäure Arginin irgendwelchen Einfluss auf die obenerwähnten Phänomene gehabt hat. Überhaupt spricht nichts dafür, dass die Zusammensetzung vom Futter in irgendeiner Weise die Ursache sein könnte für die Unterschiede, die in den Experimenten gefunden wurden.
- 3) Es ist offenbar, dass in Bezug auf Federpicken am Rücken und an den Flügeln (auch wenn sich sogar Wunden zeigten) irgend etwas im Verhalten der Vögel verantwortlich ist. Wenn die Küken nach Geschlecht geschieden wurden, hackten die Hähnchengruppen signifikant stärker. Die Sortierung nach Geschlecht hatte keinen Einfluss darauf wie stark nach den Schwanzfedern und der Kloake gehackt wurde. Die Gewichtszunahme wurde nicht von dem allgemeinen Federpicken beeinflusst, während sie bei den Vögeln, bei denen die Kloake blutig gehackt wurde, geringer war.

SAMMENDRAG

Fjerpilning og kannibalisme hos fasan- og agerhønskyllinger med særligt henblik på aminosyren arginin.

- 1) Særligt på fasan- og agerhønskyllinger kunde det vises, at hvad der i almindelighed kaldes „kannibalisme“ i forskellige grader, pilning af fjerene på ryggen og vingerne, afrivning af halefjerene og hakning af kloakken (kannibalisme i snævrere betydning), er tre af hinanden umiddelbart uafhængige fænomener.
- 2) I modsætning til resultater offentliggjort af *Sirén* (1963 a, b), fandtes der i de her behandlede eksperimenter intet der talte for, at aminosyren arginin havde nogen som helst indflydelse på de ovennævnte fænomener. Der er overhovedet intet holdepunkt for at fødens sammensætning har nogen indflydelse på de forskelle, der fandtes i eksperimenterne.
- 3) Hvad angår fjerpilning på ryg og vinger (selv så vidt, at der fandtes sår), er det åbenbart, at det drejer sig om adfærdsforhold, da de nævnte former for pilning optrådte i signifikant ringere grad i hønegrupperne end i hanegrupperne. Kønsorteringen havde ingen indflydelse på om kyllingerne rev halefjerene af hinanden, eller om gattet blev hakket blodigt. Ryg- og halepilning havde ingen indflydelse på kyllingernes vægtforøgelse. Ved kloakhakningen (altså kannibalisme), hvis den forekom i noget omfang, var vægtforøgelsen signifikant mindre.

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