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Chicken (*Gallus gallus domesticus* L.) Cuts Yield Specifics of Cobb 500 Slow and Hubbard Flex Hybrids

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Abstract Chicken (*Gallus gallus domesticus* L.) cuts yield of *wing* (drummette / middle joint / tip), *breast* (fillet / tenderloin) and *leg* (drumstick / thigh / feet) of two specific hybrids (Cobb 500 Slow - CB-Slow and Hubbard Flex - HB-Flex) were evaluated. A total of 150 birds of each hybrid (grown in separate sheds under same management) were utilized for the study. The trials were carried out under randomly design with 24 replicated for each lineage. From the data obtained it was observed that the cuts yield of CB-Slow birds was higher for *breast* when compared to HB-Flex. On the other hand, the HB-Flex birds had higher cut yields for *leg* (drumstick - meat & bone) and *wing* (drummette / middle joint / tip). Yields for *tenderloin*, *breast bone* and *upper drumstick* (meat) both hybrids did not show significant differences. The knowledge of specific chicken hybrid cuts differences, enables more accurate choices that best fits the consumer's market needs.

Keywords Chicken, Carcass, Cuts, *Gallus gallus domesticus*, Yield

1. Introduction

Chicken meat (*Gallus gallus domesticus* L.) is considered an excellent source of protein and a low caloric food, providing only 10% of the daily need. A breast fillet portion (100 g) provides 30 g of protein, on the other hand, thigh and drumstick 20 g. It is also a source of minerals (selenium, phosphorus, zinc, iron, potassium and magnesium) and vitamins of B complex (B1, B2, B6, B12 and pantothenic acid), as well as of A, C and K (present in edible viscera – liver/gizzard/heart) [1-3].

The growth speed of birds, has a directly influence on the carcass yield and cuts, which makes chicken an important piece for economic return [4]. The first Brazilian chicken cuts export ocurred in the early 80's, which led the industries to expand their slaughtering capacities and implement the automated production lines. That period marked also a change on chicken meat consumption habit in the country. These changes in the habit of consuming poultry meat also happen in other continents. Prior that, industries only produced and sold whole chicken [3, 5].

To reach consumers market needs, it is essential to keep updating the birds production characteristics (birth weight / mother age / slaughtering age & weight / average batch weight/ yield & each cuts weight). Therefore, to evaluate the differences between cuttings among chicken, knowledge on hybrids specifics is essential. They provide information on production features to meet the consumer market demand [6, 7]. The animal's carcass quality is determined primarily by its yield of *meat / bone / fat*.

It is worth emphasizing that chicken cuts specifics have been the consumers increasing demand, mainly by their food habit changes on, either of (a) *special cuts* and/or (b) *boneless products* consumption. The increasing habits of easy cuts for fast preparations [1, 8, 9].

As the birds become heavier due to their genetic enhancement and nutrition, it is expected also their yields improvement. Thus, meat companies that commercialize carcasses (whole or cuts) can better choose the exact hybrid to reach their needs.

Several hybrids (Cobb, Hubbard, Ross, Paraíso Pedres, Isa Label, Arbor Acres and Avian Farms), are already in the market and their yield in different cuts have been compared and reported in the literature with different characteristics registered specifically among *wings, breast and legs*. However, there is a lack of information on specific characteristics among each lineage [10, 11, 3, 12, 9, 13-15].

Considering the need for more accurate and specific ratings of the commercial lineages (Cobb and Hubbard), this study investigated the hybrids Cobb500 Slow (CB-Slow) and Hubbard Flex (HB-Flex) utilized in the Southern Brazil chicken production chains for different *cuts* (wing/breast/leg and *yield*) from hot carcasses (i.e., prior passing through chillers).

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2. Materials and Methods

1. *Animals:* 300 chicken (males), 42 days old, from two hybrid specific lineages (Slow-CB and HB-Flex). They were grown in 2 different sheds, separated by lineage (150 birds each). All the birds handling was performed by a single producer under same conditions according to technical material of the cooperative.
2. *Chicken capture and preparation:* when fully grown and ready for slaughtering, chickens were captured randomly, separated by their respective hybrids, weighted (hanging scale, Veit Electronics), identified by a numbered seal on both legs (Figure 1.a) and sent to the slaughtering house (after 8 h fasting) according to the National Ministry of Agriculture regulation procedure [16].
3. *Slaughtering:* chicken were previously *(a) weighed* – by means of a hanging scale, then sent for *(b) slaughtering* – through stunning, bleeding and evisceration (birds with injuries/missing parts were discarded); followed by (c) *carcasses sample collection* – 24 units of each lineage were separated (prior passing through chiller) and their seals checked (Figure 1.b) for further cuts identification.
4. Cuts preparation and deboning:
   (a) cuts preparation - the carcass parts were separated according to the different cuts Types as follows.
   GROUP I: wings (drummette/middle joint/tip)
   GROUP II: breast (filet / tenderloin *)
   GROUP III: legs (drumstick / thigh / feet)
   (b) deboning – drumstick and thighs had their bones separated, including skin and fat
   GROUP IV: drumstick & bones/ thigh & bones/back bone - deboning (Figure 2)

All procedure was carried out by the same operator using stainless steel knives. Cuts and seals (from each bird) were kept together in the same tray (expanded polystyrene) for the next step - weight. [* inside breast fillet]

   (c) weighing - each item (cuts, sub-cuts and deboning) obtained in (a) and (b) was weighed (scale, model 2090, Toledo) for yield calculation.

5. ***Cuts weight and yield versus whole carcass:*** from *birds* data obtained at the *(a) slaughtering house* (before conveyor *hanging* and after *slaughtering* - whole, clean carcass) and the *(b) cuts* obtained; the weight and yield Tests were applied (for the cuts GROUPS: I, II, III and IV) as follows.

WEIGHT TEST: with all cuts weighed, the 2 hybrids, had calculated their proportions (*meat / bone / skin*) *versus* each carcass, following features of their proper GROUPS I, II, III and IV. Those data were applied next, to calculate the yield percentage.

YIELD TEST: was carry out for the 2 chicken cuts hybrids main GROUPS, as well as carcass, i.e, (a) per unity *(cut)* and (b) total *(carcass)* - weight prior slaughtering (live and after fasting). The following equations were applied:

[a] *individual yield (%) = slaughter weight x 100 / cutting weight*

[b] *total yield (%) = sum of cuts x 100 / slaughter weight.*

Note: it is important to emphasize that it was not possible to establish the age of the broiler breeders (eggs) and chicken weight (chicks), also, for the age of the mothers (eggs) and birth weight (chicks).

6. *Statistical analysis:* it was applied ANOVA (SAS, version 9.1) and the averages compared by Tukey test ($P < 0.05$) to evaluate the significant differences.

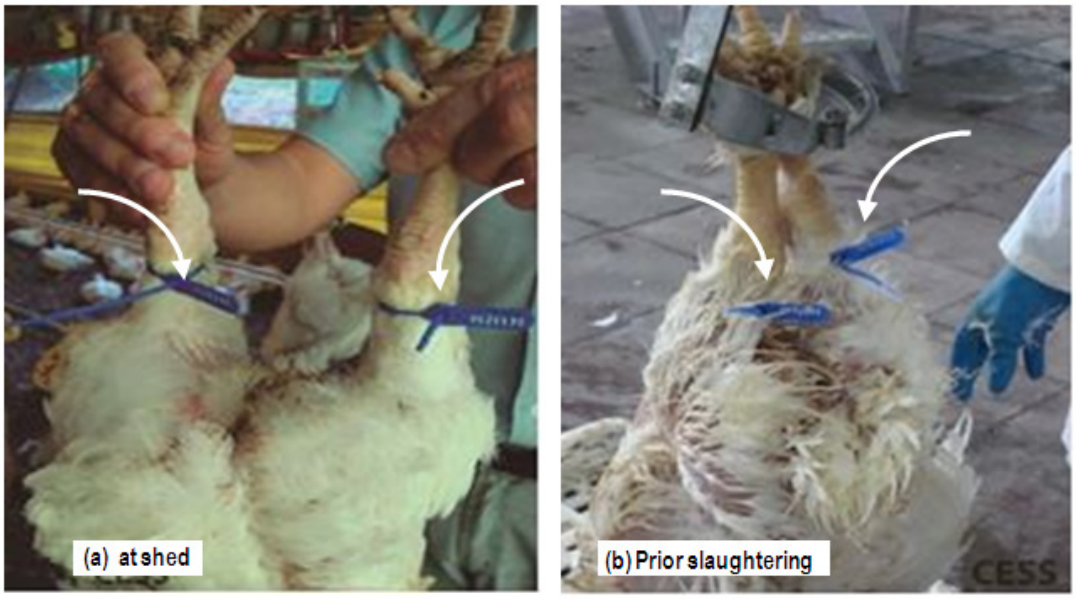

Figure 1. Chicken (*Gallus gallus domesticus* L.) seal identification for tracking individual custs at (a) shed and (b) prior slaughtering

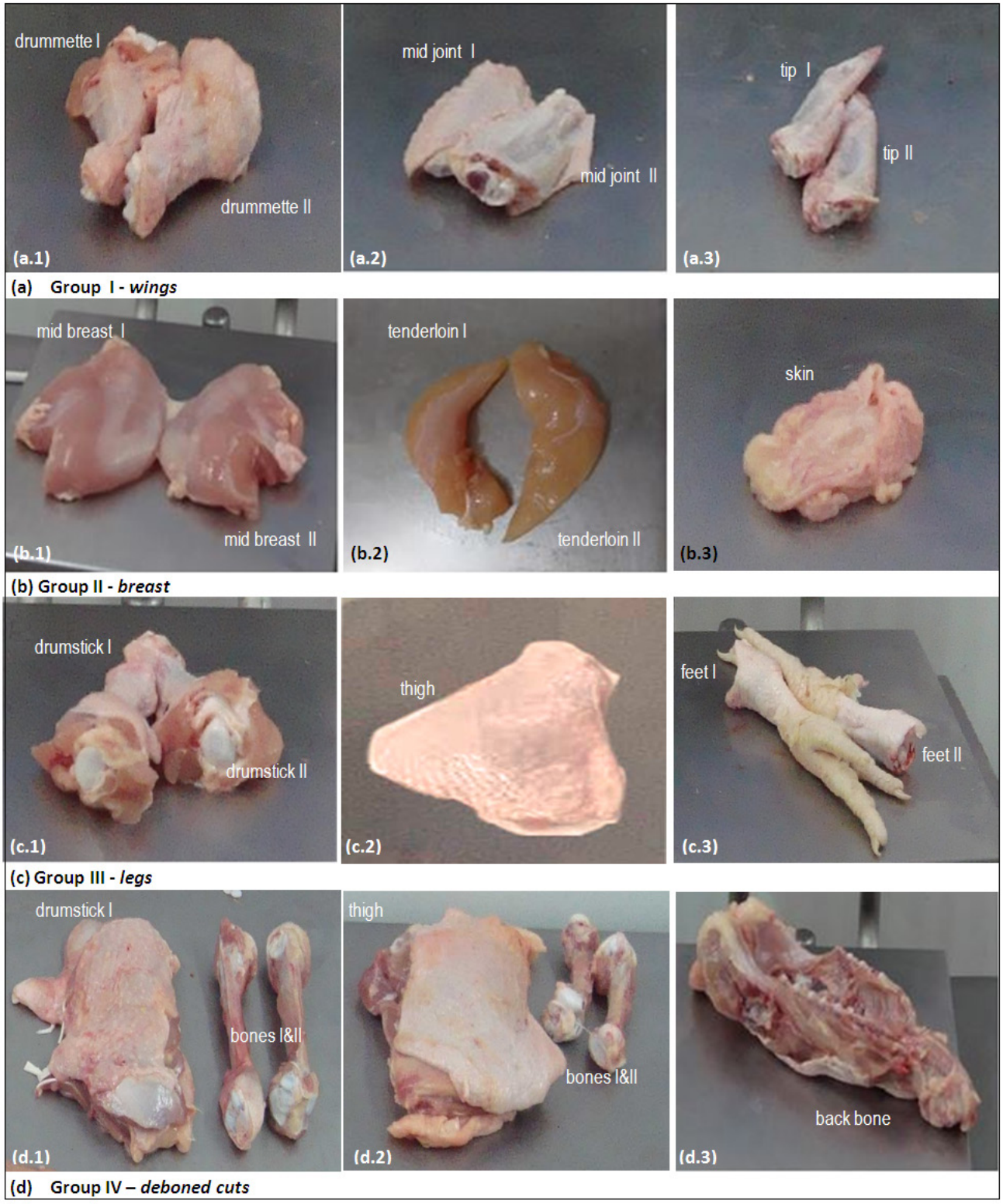

Figure 2. Chicken (Gallus gallus domesticus L.) cuts from Groups (a) I –wing; (b) II –breast; (c) III – leg and (d) IV – deboned cuts

3. Results and Discussion

From the data obtained, some differences were observed for both, weight and yield of chicken cuts of the two specific hybrids (CB-Slow and HB-Flex) evaluated in the study. The main cuts that stood in yield were *breast* (fillet & skin) and *drumstick / thighs / wings*, for the CB-Slow and HB-Flex lineages, respectively. Table below shows the weight and yield data of the chicken cuts GROUPS I, II, III and IV.

Chicken cuts from Cobb 500 Slow and Hubbard Flex hybrids – weight and yield

POULTRY CUTS[1]			COMMERCIAL HYBRID				RSD%[4]	P[5]
			CB-Slow[2]		HB-Flex[3]			
Group	Type		Average	Range	Average	Range		
[A] Weight (g)[6]								
WING	**Whole**		190.0	NA[7]	200.6	NA	NA	NA
	Drummette		95.8	79 - 101	101.4	84 -118	12.75	0.1556
	Middle**		70.7	63 - 74	73.8	64 - 92	8.82	0.1296
	Tip***		23.5[b]	21 - 25[a]	25.4[a]	22 - 30	8.42	0.0070
BREAST	**Whole**		734.8	NA	630.3	NA	NA	NA
	Fillet		452.0[a]	360 - 585	361.0[b]	284 - 467	9.39	0.0001
		skin	55.4[a]	40 - 67	44.7[b]	34 - 65	14.0	0.0002
		bone	128.6	101 - 165	131.4	102 - 166	9.84	0.6306
	Tenderloin*		98.8	53 - 120	93.2	63 - 123	14.1	0.2424
LEG	**Drumstick**	*Whole*	269.5	NA	276.4	NA	NA	NA
		meat	197.5	164 - 251	198.0	161 - 239	6.78	0.9374
		bone	72.0[b]	57 - 90	78.4[a]	67 - 89	8.05	0.0068
	Thigh	*Whole*	349.2	NA	336.0	NA	NA	NA
		meat	309.5	251 - 362	291.8	242 - 350	6.14	0.0664
		bone	39.7[b]	35 - 47	44.2[a]	39 - 51	8.87	0.0001
FEET			104.8[b]	85 - 123	114.7[a]	94 - 130	7.20	0.0026
Others	**Backbone**		310.3	270 - 368	316.3	9.9 - 14.9	8.23	0.0427
WHOLE CHICKEN [8] after fasting			2735.9	2345 - 3110	2655.2	2211 - 3535	8.19	0.2438
[B] Yield (%)[6]								
WING	**Drummette**		3.58[b]	3.1 - 4.2	3.95[a]	3.4 - 4.8	10.59	0.0038
	Middle**		2.65[b]	2.3 - 2.9	2.87[a]	2.6 -3.1	4.47	0.0001
	Tip***		0.88[b]	0.8 - 0.9	0.99[a]	0.9 - 1.1	5.69	0.0001
BREAST	**Fillet**		16.95[a]	13.0 – 20.0	14.00[b]	11.8 - 15.9	9.39	0.0001
		skin	2.08[a]	1.6 - 2.6	1.73[b]	1.3 - 2.4	14.00	0.0002
		bone	4.83	3.9 - 5.7	5.11	4.2- 6.7	9.84	0.0689
	Tenderloin*		3.70	1.9 - 4.5	3.63	2.4 - 4.2	14.10	0.6409
LEG	**Drumstick**	*meat*	7.40[b]	5.9 - 8.3	7.72[a]	6.4 - 8.9	6.78	0.0470
		bone	2.70[b]	2.4 - 3.1	3.06[a]	2.6 - 3.5	8.05	0.0001
	Thigh	*meat*	11.63	10.3 - 13.3	11.36	9.7 - 12.9	6.14	0.2375
		bone	1.49[b]	1.3 - 1.9	1.72[a]	1.4 - 2.0	8.87	0.0001
FEET			3.93[b]	3.5 - 4.6	4.48[a]	3.9 - 5.0	7.20	0.0001
Others	**Backbone**		11.65[b]	9.70 - 12.7	12.28[a]	9.9 - 14.9	8.23	0.0427

[1]42 days growth [2]Cobb 500 Slow [3]Hubbard Flex [4]coefficient of variation [5]probability [6]weight and yield [7]not applicable [8] including feathers, after fasting
a,b: medium followed by different letters in the same vein differ ($P < 0.05$) statistically by Tukey test 5% * inside the breast fillet.** middle joint wing *** wing tip

WEIGHT - CUTS & CARCASS

(A) CUTS (MEAT X BONE): the cuts are fraction with or without skin / bone and mutilations. For export the *wing* is marketed as drummette, mid-wing and wing tip. Although the *breast* is the major focus for the different sectors of the meat industry, the thigh and drumstick are the most consumed products, mainly in the South, Southeast and Midwest regions of Brazil [17]. In the evaluation of this study for cuts, through their average weight (absolute value), it was observed that the HB-Flex hybrid the highest bone weight (both thigh and the drumstick). As shown in the Table above. Even with the highest average drumstick bones weight, the HB-Flex hybrids presented a lower weight of *full leg quarters*, when compared to CB-Slow. The HB-Flex also presented larger *whole thigh* (meat and bone) weight. So, in that hybrid, the *thigh*'s bone was responsible for the higher *thigh* weight. The other *breast* parts (tenderloin and bone), *wings* (drummette and middle joint wing) and *leg* (thigh and

drumstick), as well as the *back*, no significant differences were recorded ($P < 0.05$). In the literature, [14] found best results in *breast* weight (Group II) only on hybrid CB (at 35 days of age, using 3 different feed composition). On the other hand, for the HB commercial hybrid, the authors reported best weights and yields for *legs (thigh* and *drumstick)*. In results reported by [12] the authors did not observe a significant difference between those hybrids (for different cuts) because they utilized different parameter ($P > 0.10$). However if it was observed at $P<0.05$, significant differences between those cuts would be observed, as reported, only for boneless legs, by the authors. (*Note: the *leg* drumstick and thigh subdivisions, had their meat considered whole weight, including the skin).

(B) CARCASS: chicken carcass is the product without viscera, usually weighing below 2000 g for use in the meat products industry (as cuts). Above this weight, it is more used for frozen whole. Some authors describe the carcass: with or without neck, head and viscera edible.

YIELD - CUTS

(A) INDIVIDUAL: as expected, the average yield of all chicken cuts of the specific hybrids (CB-Solw and HB-Flex) evaluated, presented differences. It was possible to observe that the CB-Slow birds presented a better average yield for Group II, i.e., *breast*. These data is supported by literature, where authors such as [9, 14, 12], also reported high yields for hybrid CB. On the other, in the present study, the highest yield Groups I - *wing* (drummette, middle joint and tip) and some of the Group III - legs, i.e., *drumstick* (whole and bone), *thigh bone* and *feet*, as well as other cuts - *back*, were obtained by birds of the HB-Flex. Flemming and Winkelstroter [12, 14] also found high yield of *wing* and *legs* for HB. It was considered the yield of other cuts (*tenderloin / drumstick*) obtained in the current study, of no significant difference for CB-Slow and HB-Flex ($P < 0.05$). Studying CB hybrid, the authors reported higher breast and sable production (34.20 and 16.20%, respectively) than other pedigrees (Paraiso Pedres and Isa Label). However, the authors did not compare the data with the HB, but reported that the proportion of wing / leg / back was higher for the other lines studied, which was also observed in the present study [9]. However the cuts mentioned were not transected on meat and bone. The variations in yield cuts in hybrids, have been attributed to the growth rates and age at slaughtering as well as the fact that most of these hybrids (especially CB), are selected with a focus on yield *breast*. Using the Ross 308 strain Havenstein and Young et al [18, 19] found 15.2 and 20% yields of breast meat, in poultry slaughtered at 43 and 44 days, respectively. In contrary to the reported above, when they are compared to other lineages (Arbor Acres and Ross), some variations have been reported. Mendes [10] by comparing HB with Arbor Acres, found that the second hybrid showed the highest percentage of *leg* meat ($P < 0.05$) to HB (better feed conversion). Vieira [13], comparing *breast* yield (CB and Ross), stated that the hybrid Ross showed the highest yield for *breast* meat (31 days of age) than the CB, which obtained best results for *thigh and drumstick* (using different diets with protein profiles). Authors such as Stringhini and Boldorini et al [11, 15] did not observe significant differences between the two lineages. Comparing the broiler (male) meat yield and weight [20] found in CB and HB lineages yields of breast with bone of 20.43 and 19.51 and values in drumstick yield of 10.63 to 10.51, respectively.

(B) TOTAL: the 2 hybrids whole weight averages before and after slaughtering (carcasses yield) were 2665.10 & 2566.38 g and 73.69 & 73.49%, respectively [21]. These data, were reported also by Winkelstroter [14] for the CB (84.69 and 84.49%) and HB (3024 and 3129 g) hybrids as a middle weight. In diets with levels of 3000 kcal/kg. Meza et al [22] found CB carcass yield of 73.17%. The HB lineage according to Barbosa et al [23] presented 82.71% yield at 49 days of age.

4. Conclusions

The results obtained allow to infer that there was a significant difference between the two hybrids (CB-Slow and HB-Flex) tested characteristics, both for cuts weight and yield. The CB-Slow showed to be better on weight and yield of *breast* meat. The HB-Flex offers best results for *wing* and *thigh*. Important to emphasize the need for more detailed information about the hybrids (CB, CB-Fast and specific CB-Slow) when reported in the literature, as nuances of each lineage can make a difference in the final cuts data obtained in a study.

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