



(86) Date de dépôt PCT/PCT Filing Date: 1999/02/17
 (87) Date publication PCT/PCT Publication Date: 1999/09/16
 (45) Date de délivrance/Issue Date: 2003/10/14
 (85) Entrée phase nationale/National Entry: 2000/09/08
 (86) N° demande PCT/PCT Application No.: NO
 1999/000051
 (87) N° publication PCT/PCT Publication No.: 1999/045796
 (30) Priorité/Priority: 1998/03/10 (19981035) NO

(51) Cl.Int.⁶/Int.Cl.⁶ A23K 1/16, A23K 1/18
 (72) Inventeur/Inventor:
 KOPPE, WOLFGANG M., NO
 (73) Propriétaire/Owner:
 NUTRECO AQUACULTURE RESEARCH CENTRE A/S,
 NO
 (74) Agent: RIDOUT & MAYBEE LLP

(54) Titre : ALIMENTS POUR POISSONS D'ELEVAGE SOUS FORME DE REGIME ALIMENTAIRE, ET PROCEDE D'ALIMENTATION
 (54) Title: FISH FODDER FOR BREEDING PURPOSES, IN THE FORM OF A DIET, AND A FEEDING PROCEDURE

(57) **Abrégé/Abstract:**

In a fish fodder for breeding purposes, in the form of a diet containing i.a. protein and fat as well as one or more agents to favour the visual pigmentation of the fillets in the form of desired pink colouring, one has experienced improved pigmentation results from diet fodder containing a lysine concentration of at least 8.6 % of the protein in the diet fodder. In a procedure of feeding associated to this diet fodder, the feeding with diet fodder is restricted to a brief period of time in the order 4-8 weeks immediately before the slaughtering point of time.

PCTWORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

| | | |
|--|-----------|---|
| (51) International Patent Classification ⁶ : A23K 1/16, 1/18 | A1 | (11) International Publication Number: WO 99/45796 (43) International Publication Date: 16 September 1999 (16.09.99) |
| (21) International Application Number: PCT/NO99/00051 (22) International Filing Date: 17 February 1999 (17.02.99) (30) Priority Data: 19981035 10 March 1998 (10.03.98) NO (71) Applicant (for all designated States except US): NUTRECO AQUACULTURE RESEARCH CENTRE AS [NO/NO]; Sjøhagen 3, Postboks 48, N-4016 Stavanger (NO). (72) Inventor; and (75) Inventor/Applicant (for US only): KOPPE, Wolfgang, M. [NO/NO]; Søren Årstadsvei 31, N-4011 Stavanger (NO). (74) Agents: HÅMSØ, Borge et al.; Håmsø Patentbyrå Ans, P.O. Box 171, N-4301 Sandnes (NO). | | (81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> |
| (54) Title: FISH FODDER FOR BREEDING PURPOSES, IN THE FORM OF A DIET, AND A FEEDING PROCEDURE | | |
| (57) Abstract | | |
| <p>In a fish fodder for breeding purposes, in the form of a diet containing i.a. protein and fat as well as one or more agents to favour the visual pigmentation of the fillets in the form of desired pink colouring, one has experienced improved pigmentation results from diet fodder containing a lysine concentration of at least 8.6 % of the protein in the diet fodder. In a procedure of feeding associated to this diet fodder, the feeding with diet fodder is restricted to a brief period of time in the order 4-8 weeks immediately before the slaughtering point of time.</p> | | |

FISH FODDER FOR BREEDING PURPOSES, IN THE FORM OF A DIET, AND
A FEEDING PROCEDURE

This invention relates to a fodder for fish being bred, especially a diet fodder for salmonids, containing at least one
5 agent for improving the visible pigmentation of the fillets. Likewise, the invention concerns a feeding procedure associated with this diet fodder.

Synthetic pigments are added to fodder for salmonids in order to give the fillets a pink (salmon red) colour. The price
10 for this additional fodder ingredient in the form of coloured matter constitutes approximately 20 percent of the total price of the diet fodder. The pigment content of the fodder should, thus, be reduced.

At the same time, the predictability for achieving a sufficiently visible fillet pigmentation is low in fish having
15 been allotted a certain diet, and the fish breeders risk, therefore, to slaughter fish not having obtained the intentional pigmentation.

Therefore, it would be desirable to have at one's disposal
20 means to improve visible pigmentation in salmonids and to put the means to use shortly before the slaughtering, without

having to increase the pigment level when planning the composition of the diet.

Known pigmentation technique comprises to feed salmonids with composite fodder substances containing between 30 and
5 100 mg/kg carotenoids, astaxanthin and/or canthaxanthin.

To meet target pigmentation at harvest, fish are sampled in the course of its growing period, and fillet pigmentation is monitored.

In order to secure an adequate pigmentation at the point of
10 time for slaughtering, it may be necessary to use very high pigment levels. This increases the fodder costs and, thus, the production costs. Moreover, the reaction time is far too long. Many studies have shown that the pigment content of the fodder seems to have resulted in only 50% of the visual pig-
15 mentation which is measured by means of optical and visual means. Thus, increasing concentration of pigments does not secure an increasingly visible colouring of the fillets. Known pigmenting technique associated with desired fillet colour of slaughtered fish thusly bred, especially salmonids,
20 is, therefore, not predictable to a desired extent.

The object of this invention has been to provide a special diet for feeding especially salmonids during a short period prior to slaughtering, in order to increase the visible pigmentation of the fish meat.

25 The object is realised by means of a fodder containing a concentration of at least 8.6 % lysine based on the protein in a diet fodder, and through a relatively brief feeding with such diet fodder - 4-8 weeks before slaughtering.

By means of this lysine-containing diet fodder according to
30 the invention, it is, during the indicated short feeding pe-

riod, achieved a statistically significant increase of the pigmentation of the fillets perceived visually, without having to alter the pigment levels in the diet fodder.

Lysine (α,ϵ -diaminocaproic acid) is an essential amino acid in fodder for fish. Lysine is either derived from the natural raw materials used in fish fodder compositions, or it is added in the synthetic form thereof. Requirement for lysine addition in salmon fodder to cause optimal growth of salmon is 19,9 g lysine/kg diet or 3.8 % of the protein in the diet. (Anderson et al 1992).

Visual pigmentation of fish fodder when using carotenoides depends on two factors:

- a) concentration of pigments in the fish meat, and
- b) the physical, structural and chemical properties of the muscles. Only about 50% of the visible colour can be explained through pigment concentration. The rest descends from the way the muscle fibres reflect light.

On the basis of the studies carried out hitherto, the present invention seems to affect the way in which the fish meat reflects light. Even when the pigment level is increased compared to control groups, the visible colour outcome is far higher than expected based on the difference in pigment concentration. Measurement of colour components by means of a chromameter (Minolta values) seems to indicate a consistent reduction in Minolta L-value in fish bred with fodder substances having a high lysine content. The L-value decides the quality of the lightness of the fillet, involving that the fillets of these fish appear to be darker than otherwise.

Diet fodder containing lysine above the above-mentioned limit value in accordance with the present invention has also

been used for rainbow trout where a similar effect was provided. There is reason to believe that also other salmonids and non-salmonid fish which by nature has reddish or pink fillet flesh, will react on the same positive way in respect of the lysine-containing diet fodder according to the invention.

The remaining composition of the diet fodder does not seem to have any perceptible influence on the visible pink colouring of the fillet flesh of the fish. Thus, the diet fodder's nutrient and raw material content may in so far vary according to what is desirable/necessary within the scope of the present invention.

During a series of tests Atlantic salmon having an average initial weight at the first day of the test of about 2 kg, were fed with diets as defined in the below table for 6 weeks.

After 6 weeks 10 test fish from each test group were sampled out for analyses, and the pigmentation was measured in the fillets.

Statistic analyses were conducted by means of Duncan's multiple range test (ranking test). Different letters above the columns in the figures indicate significant differences at significance value (p) equal to or smaller than 0.05.

Figures 1, 2 and 3 show Roche colour card score on various locations of the fillet (location A = shoulder; location B = back; location C = belly flap).

Figure 4 shows the average astaxanthin concentration in the whole homogenised fillet of the experimental fish.

The astaxanthin concentration for group 8 differed from group 4 (figure 4) only. On the other hand, the visual pigmentation measured by means of Rock colour card, was significantly higher in group 8 as compared with all the other groups (figures 1 - 3).

T a b l e 1
Chemical composition in the experimental diets

| Diet No. | Astaxanthin mg/kg | Protein % | Fat % | Lysine % of Protein |
|----------|----------------------|--------------|----------|------------------------|
| Diet 1 | 36.2 | 43.2 | 34.7 | 5.9 |
| Diet 2 | 34.6 | 42.5 | 35.3 | 6.4 |
| Diet 3 | 36.8 | 42.3 | 34.9 | 6.8 |
| Diet 4 | 34.1 | 42.1 | 36.5 | 7.1 |
| Diet 5 | 34.2 | 42.9 | 36.4 | 7.2 |
| Diet 6 | 34.2 | 43.0 | 36.2 | 7.5 |
| Diet 7 | 34.4 | 42.6 | 35.6 | 8.1 |
| Diet 8 | 33.9 | 42.6 | 34.9 | 9.1 |

During a later experiment, two groups of rainbow trout were fed with two diets in sea water. The trout had an average initial weight of 2.7 kg and an average final weight of 3.3 kg. The diet composition is expressed in table 2:

T a b l e 2
Chemical composition of the experimental diets

| Fodder code | Astaxanthin (mg/kg) | Protein % | Fat % | Lysine % of Protein |
|---------------------|------------------------|--------------|----------|------------------------|
| Low lysine content | 39.1 | 40.6 | 29.1 | 6.15 |
| High lysine content | 38.0 | 38.1 | 31.9 | 8.58 |

The fish were fed with these diets for 47 days, and 14 fish
 5 were sampled from each group for testing at the end of the
 test. Roche colour card was read on location B (back) and C
 (belly flap). Figures 5 and 6 show these results. Again, the
 diet containing the high lysine concentration increased the
 visual pimentation of the fillet at the two reading loca-
 10 tions.

Referances:

Anderson, J. S., S. P. Lall, D. M. Anderson and Mary A. Mc
 Niven 1992: Quantitative dietary lysine requirement of Atlan-
 tic Salmon (*Salmo salar*) fingerlings: Can. J. Fish. Aquat.
 15 Sci. 50:- 316-322:

- 7 -

CLAIMS:

1. A fish fodder for breeding purposes, in the form of a diet containing at least one agent serving to improve the visual pigmentation of the fillet, characterized in that the diet fodder contains lysine in a concentration of at least 8.6 % of the protein
5 in the diet.
2. A fish fodder for breeding purposes, as claimed in claim 1, characterized in that the fodder contains a carotenoid.
3. A method for feeding fish for breeding purposes, with a diet fodder as defined in claim 1 or 2, characterized in that the diet feeding exclusively is effected within a
10 short period of time of 4-8 weeks, and that this period of time is terminated with the starving period of the fish prior to slaughtering.
4. A method for feeding fish, as claimed in claim 3, wherein the fish are salmonids.

1/6
Figure 1

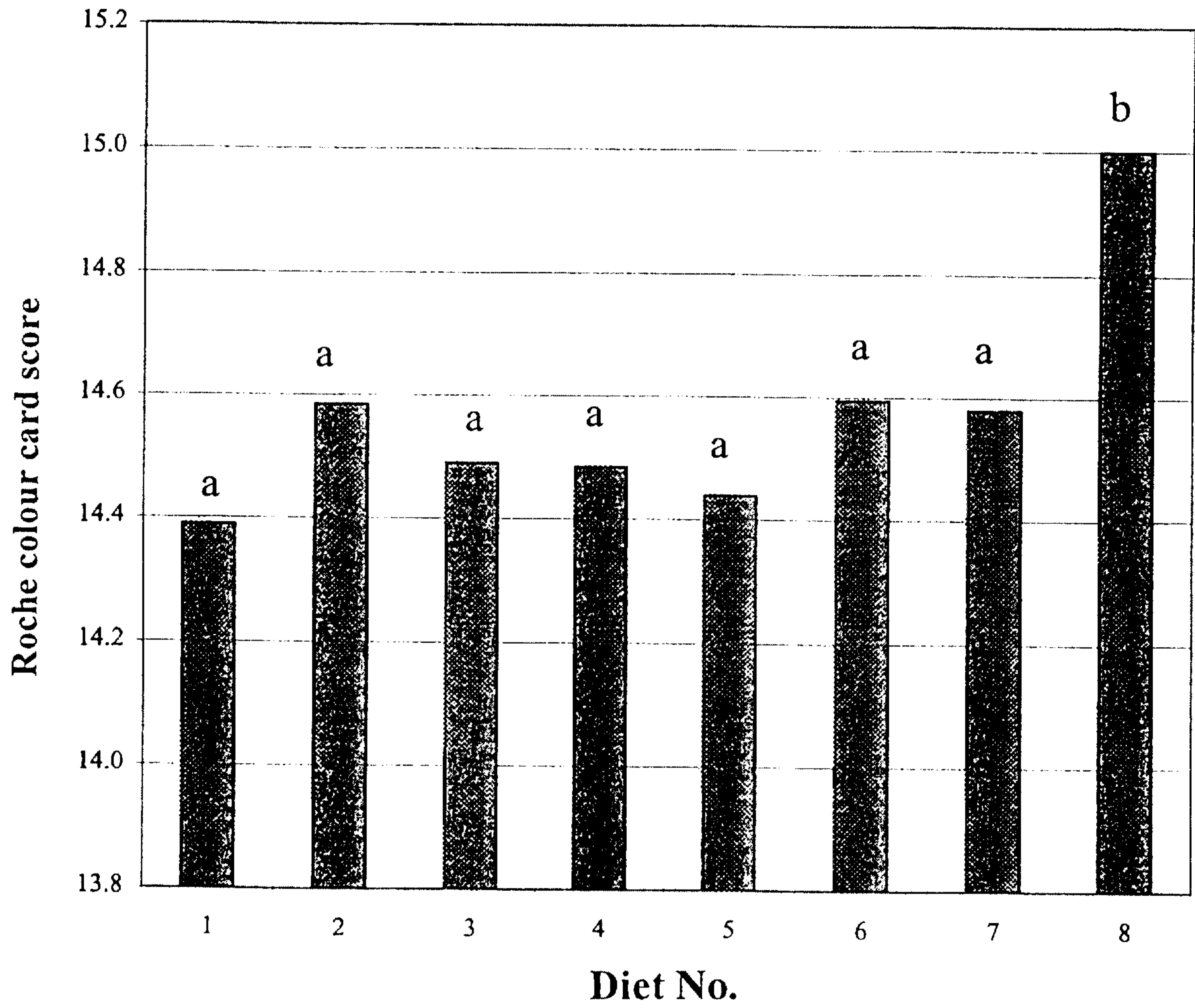
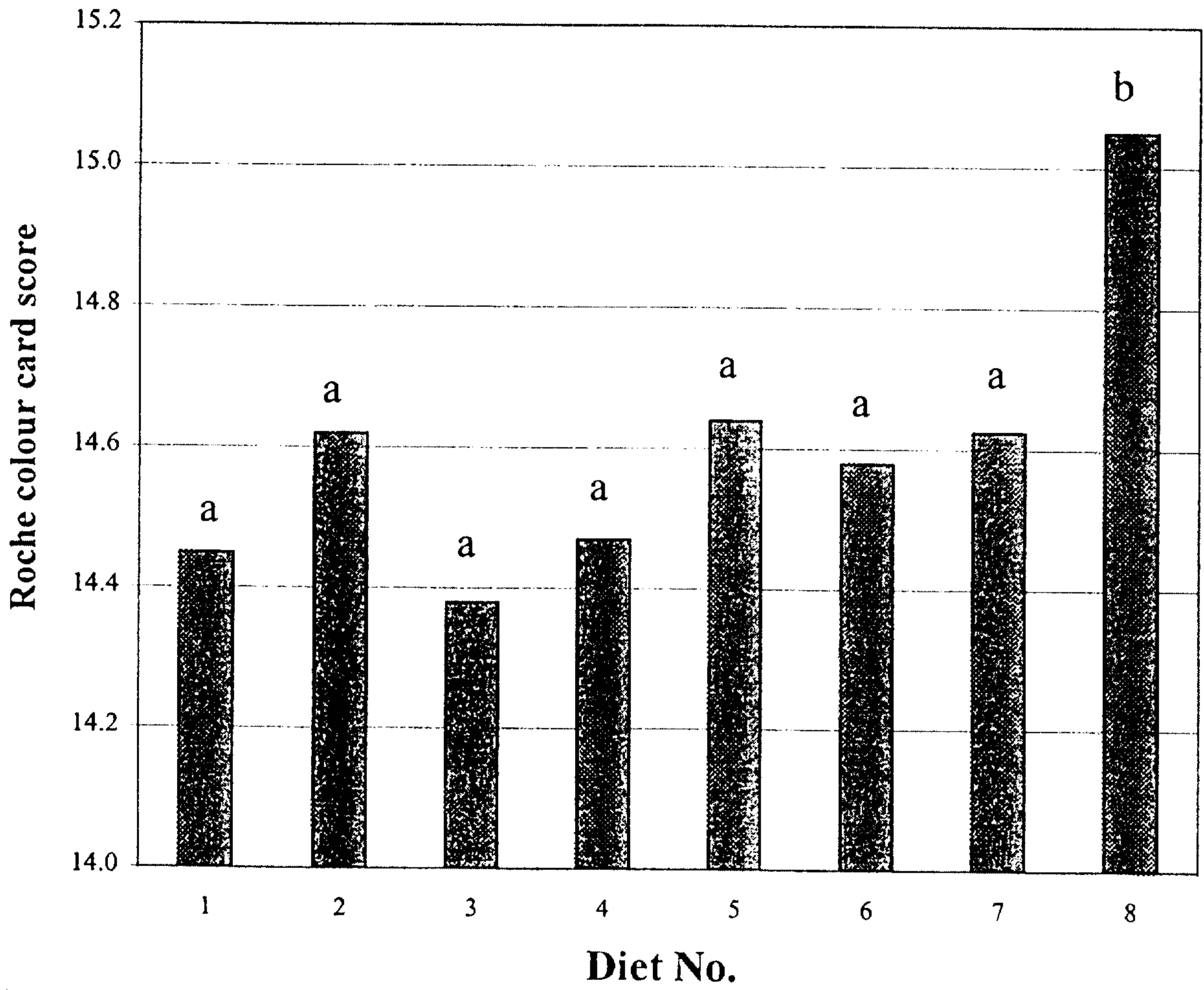


Figure 2



3/6
Figure 3

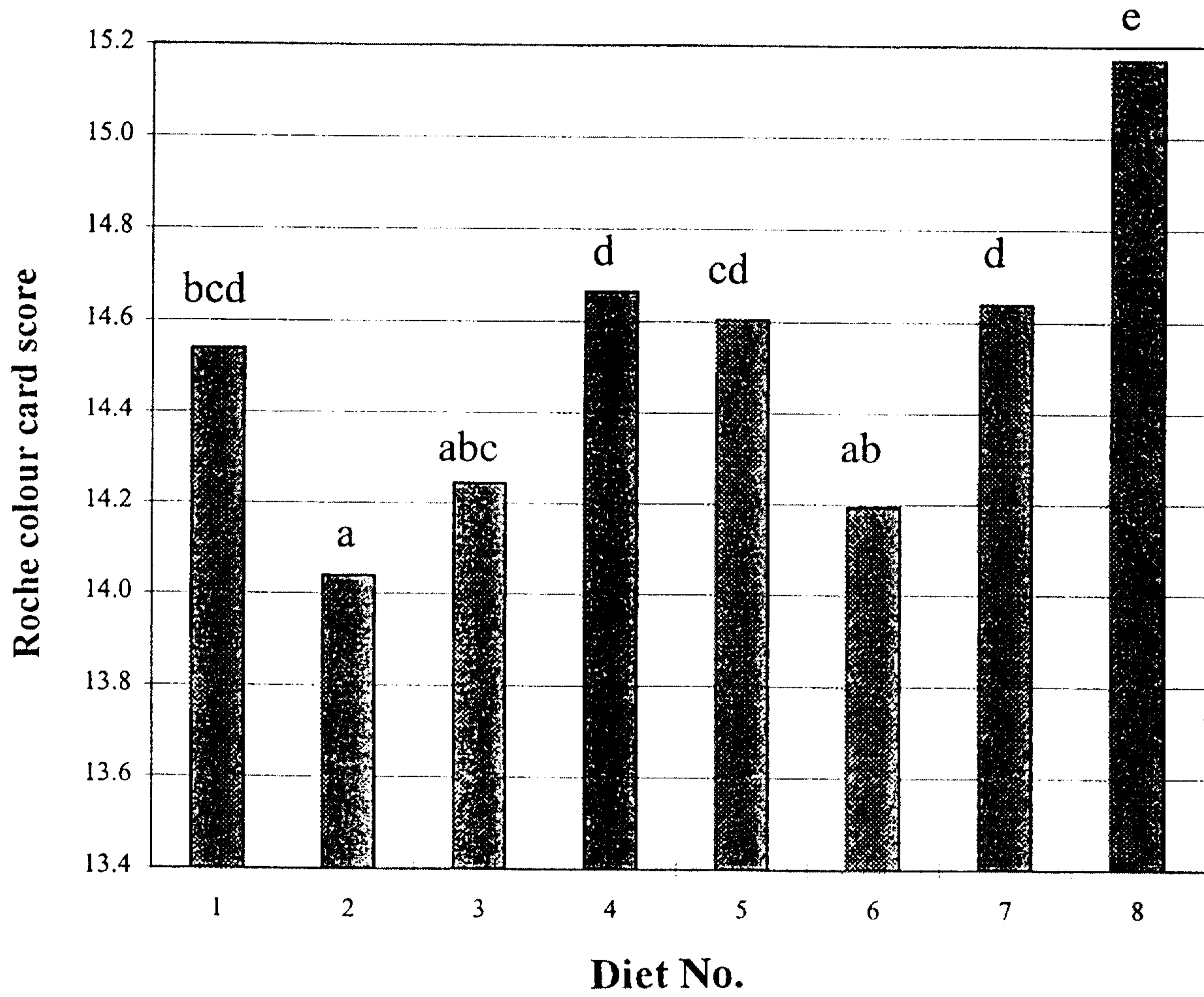


Figure 4

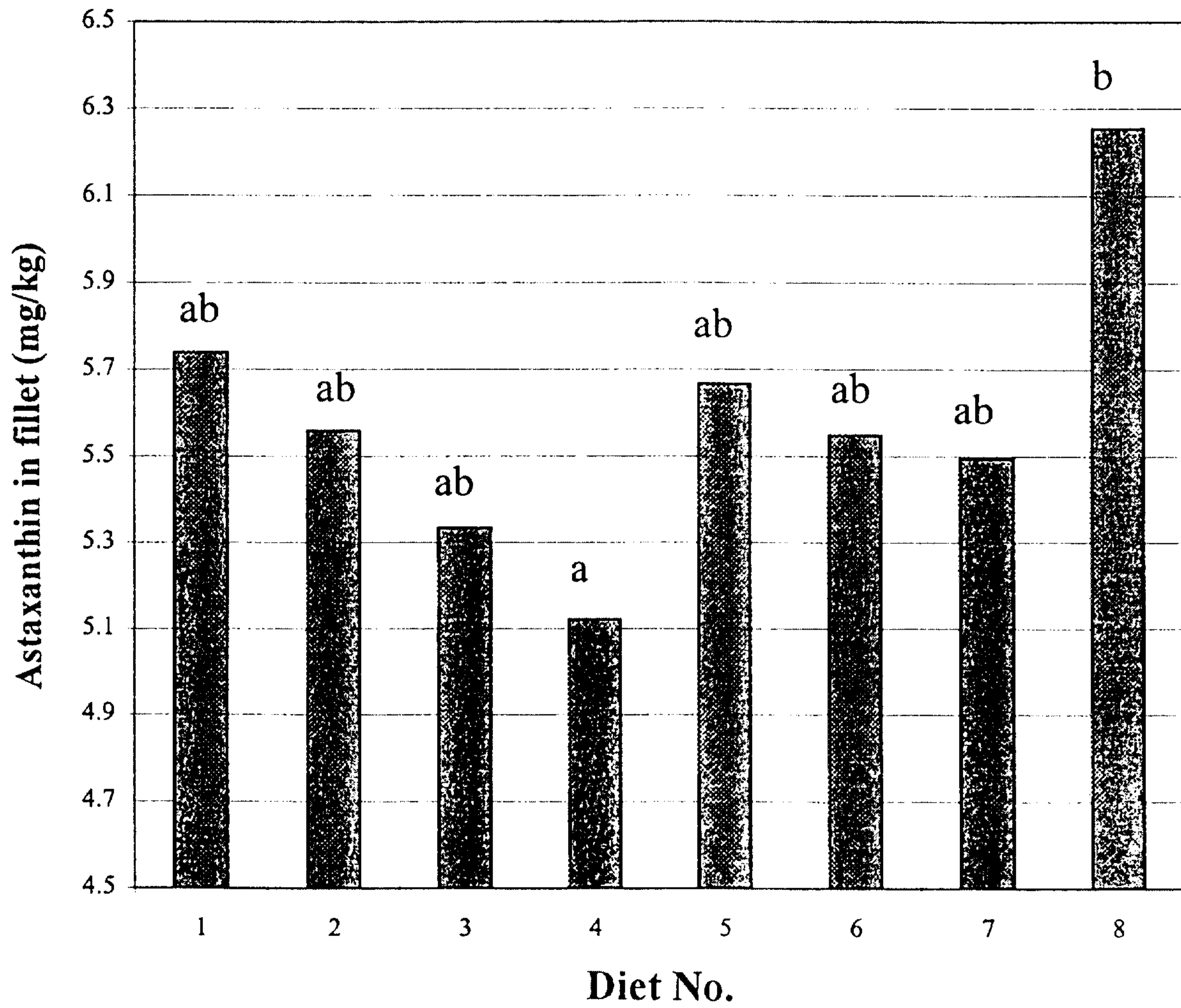


Figure 5

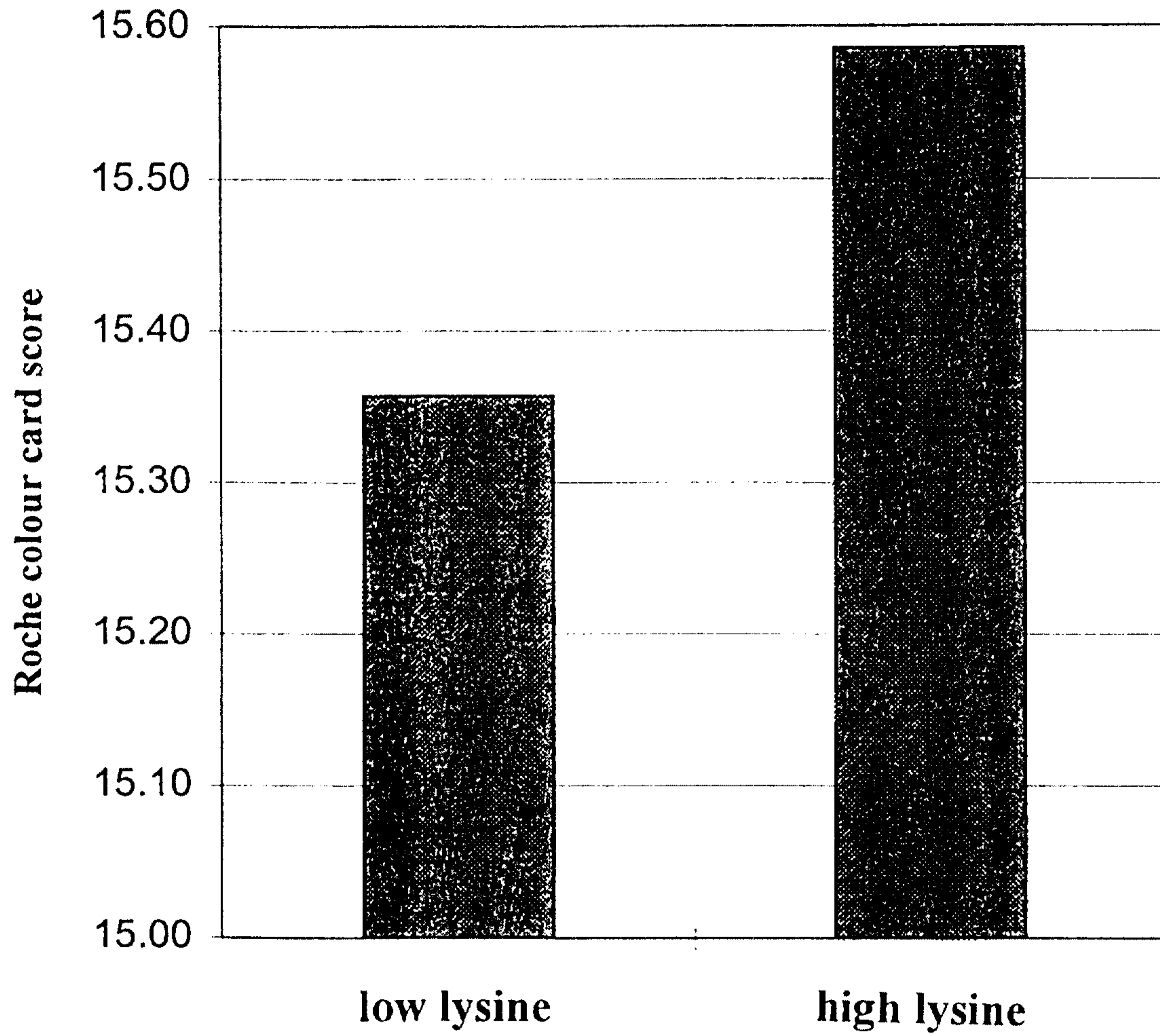


Figure 6

