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(12) (19) (CA) **Demande-Application**

(21) (A1) **2,322,814**
(86) 1999/02/17
(87) 1999/09/16

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(51) Int.Cl.[6] A23K 1/16, A23K 1/18
(30) 1998/03/10 (19981035) NO

(54) **ALIMENTS POUR POISSONS D'ELEVAGE SOUS FORME DE REGIME ALIMENTAIRE, ET PROCEDE D'ALIMENTATION**

(54) **FISH FODDER FOR BREEDING PURPOSES, IN THE FORM OF A DIET, AND A FEEDING PROCEDURE**

(57) Dans un aliment pour poissons d'élevage sous forme de régime alimentaire contenant une protéine et des matières grasses ainsi qu'un ou plusieurs agents destinés à favoriser la pigmentation visuelle des filets, par une coloration rose voulue, on observe de meilleurs résultats en matière de pigmentation à partir d'aliments constitutifs de régime renfermant une concentration en lysine d'au moins 8,6 % de la protéine. Dans un procédé d'alimentation associé à ces aliments constitutifs de régime, l'alimentation à base de ces aliments se limite à une courte période, de l'ordre de 4 à 8 semaines, juste avant le moment de l'abattage.

(57) 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.

PCT WORLD 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

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(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
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.

(54) Title: FISH FODDER FOR BREEDING PURPOSES, IN THE FORM OF A DIET, AND A FEEDING PROCEDURE

(57) 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.

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 salmonoides, containing at least one 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 salmonoides in order to give the fillets a pink (salmon red) colour. The price 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 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 means to improve visible pigmentation in salmonoides 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 salmonoides with composite fodder substances containing between 30 and 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 time for slaughtering, it may be necessary to use very hight 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 pigmentation 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 salmonoides, is, therefore, not predictable to a desired extent.

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

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 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-diaminocapronic 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 salmonoides and non-salmonoid 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 following claims.

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).

Table 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:

Table 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 were sampled from each group for testing at the end of the test. Roche colour card was red 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 locations.

Referances:

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

C l a i m s

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, c h a r a c t e r i z e d i n that the diet fodder contains lysine in a concentration of at least 8.6 % of the protein in the diet.

2. A fish fodder for breeding purposes, as claimed in claim 1, c h a r a c t e r i z e d i n that the fodder contains a carotenoid.

3. A method for feeding fish for breeding purposes, especially salmonoides, with a diet fodder as defined in any one of the preceding claims, c h a r a c t e r i z e d i n that the diet feeding exclusively is effected within a short period of time in the order of 4-8 weeks, and that this period of time is terminated with the starving period of the fish prior to slaughtering.

Figure 1

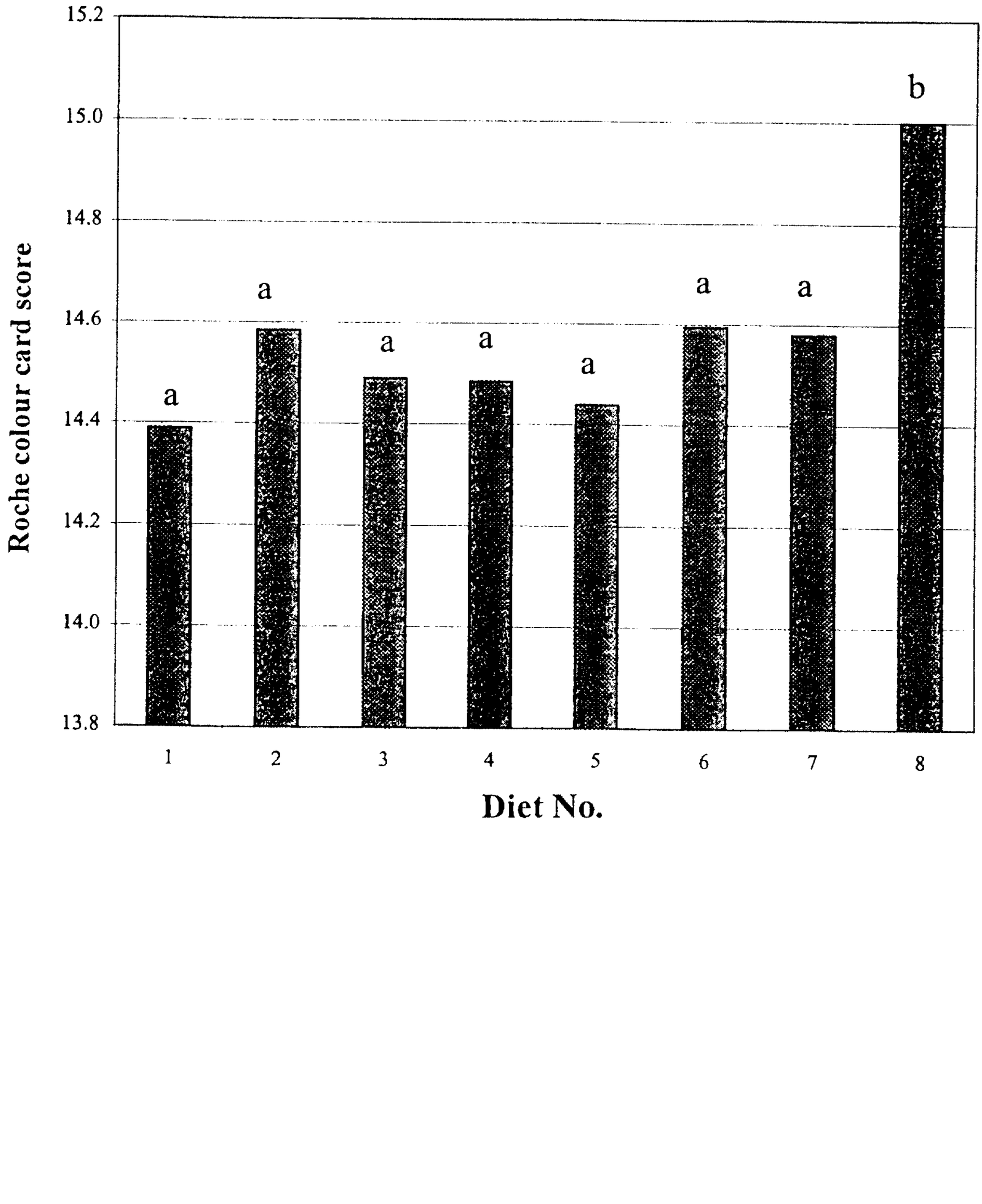

15.2
15.0
14.8
14.6
14.4
14.2
14.0
13.8
Roche colour card score
a
a
a
a
a
a
a
b
1
2
3
4
5
6
7
8
Diet No.

Figure 2

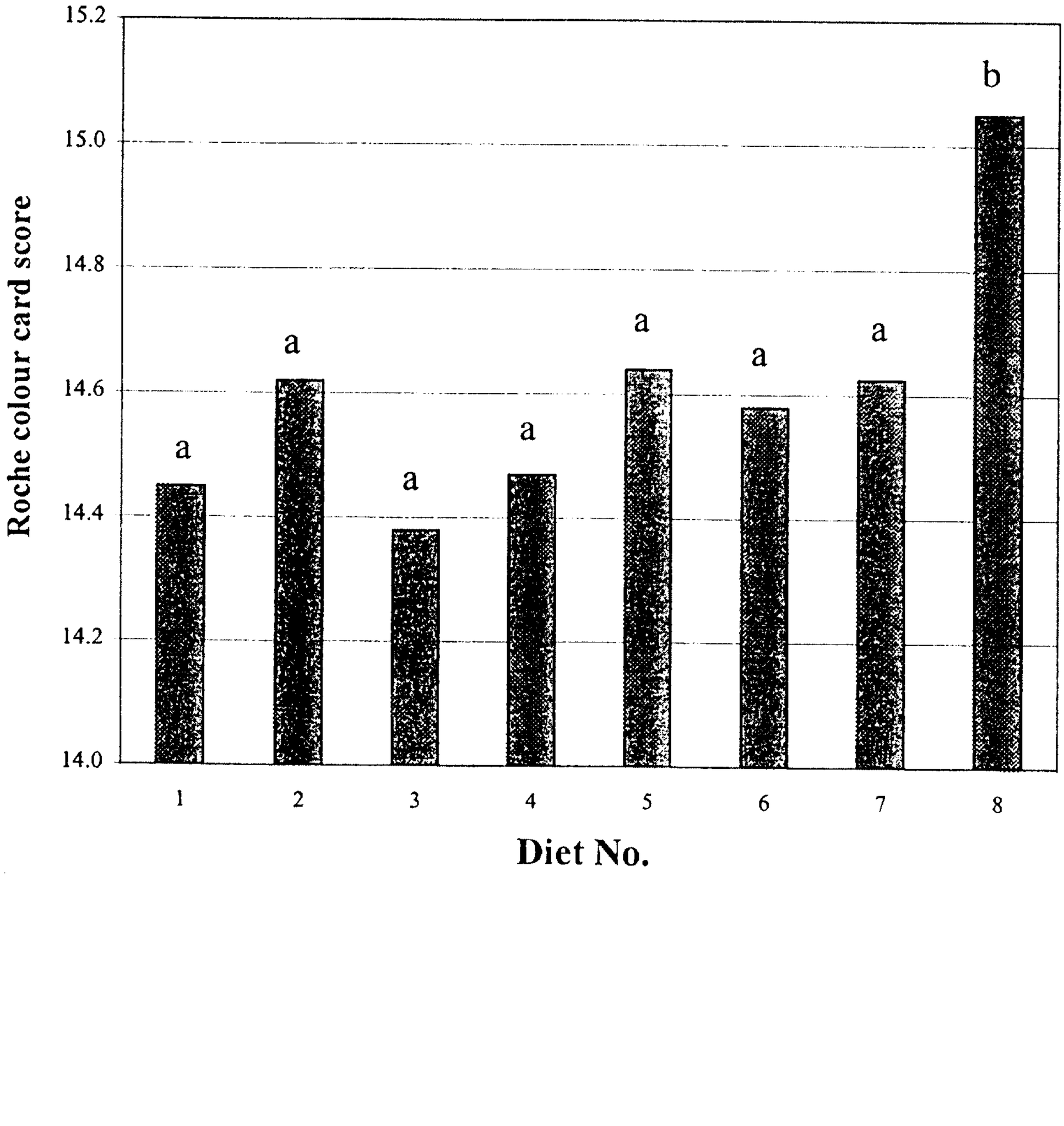

15.2
15.0
14.8
14.6
14.4
14.2
14.0
Roche colour card score
a
a
a
a
a
a
a
b
1
2
3
4
5
6
7
8
Diet No.

Figure 3

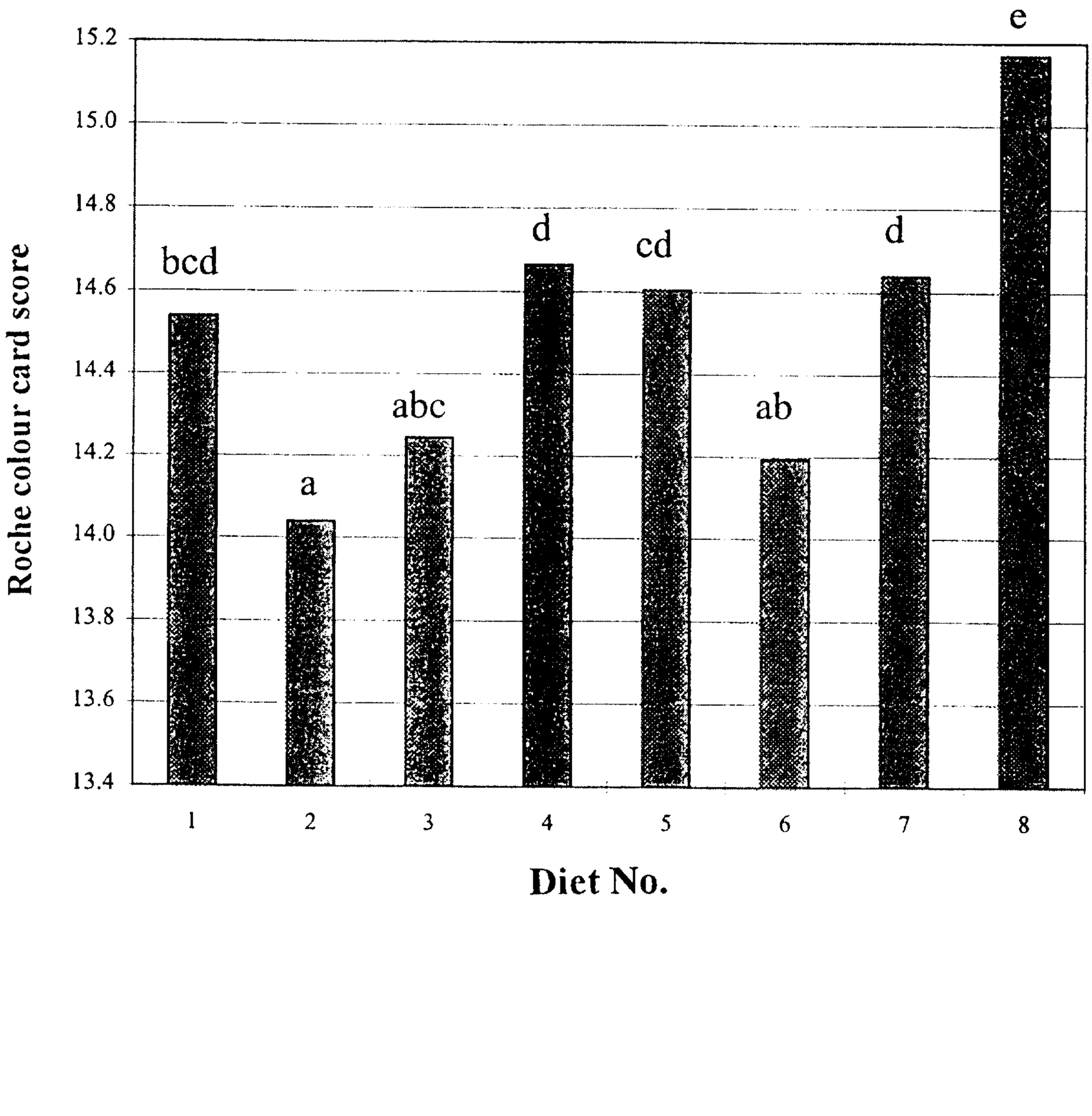

Roche colour card score
15.2
15.0
14.8
14.6
14.4
14.2
14.0
13.8
13.6
13.4
bcd
a
abc
d
cd
ab
d
e
1
2
3
4
5
6
7
8
Diet No.

Figure 4

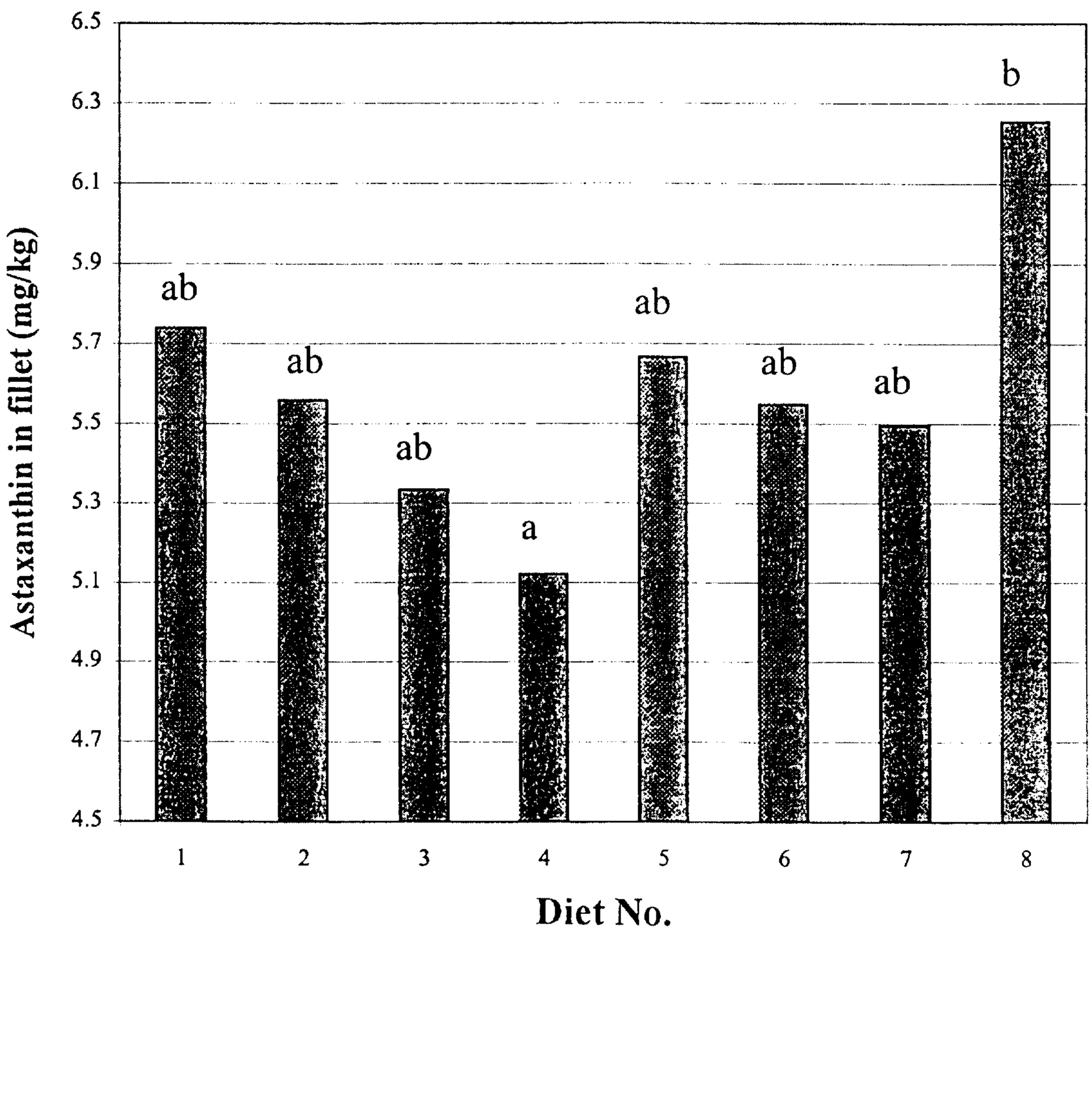

Astaxanthin in fillet (mg/kg)
6.5
6.3
6.1
5.9
5.7
5.5
5.3
5.1
4.9
4.7
4.5
ab
ab
ab
a
ab
ab
ab
b
1
2
3
4
5
6
7
8
Diet No.

Figure 5

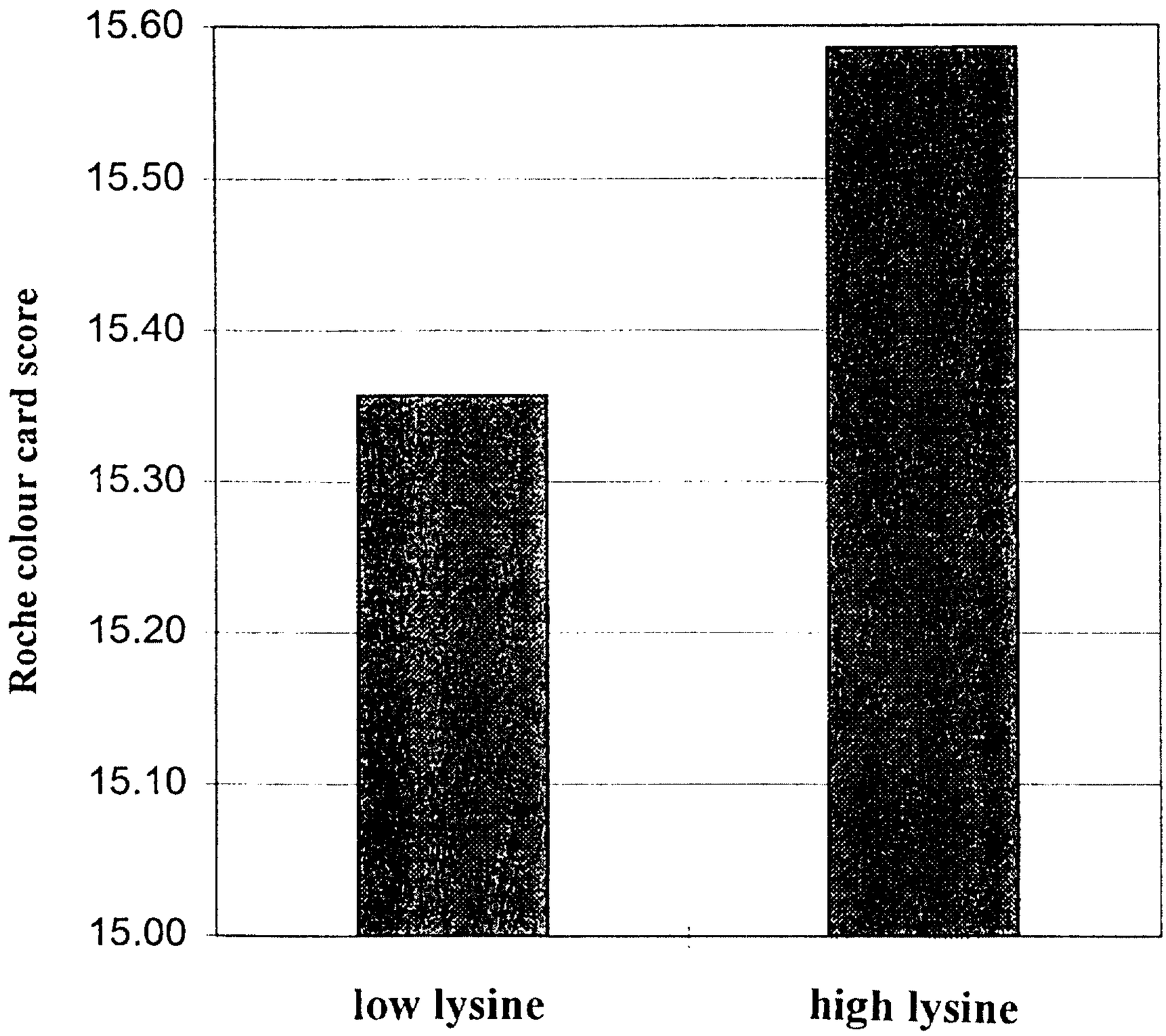
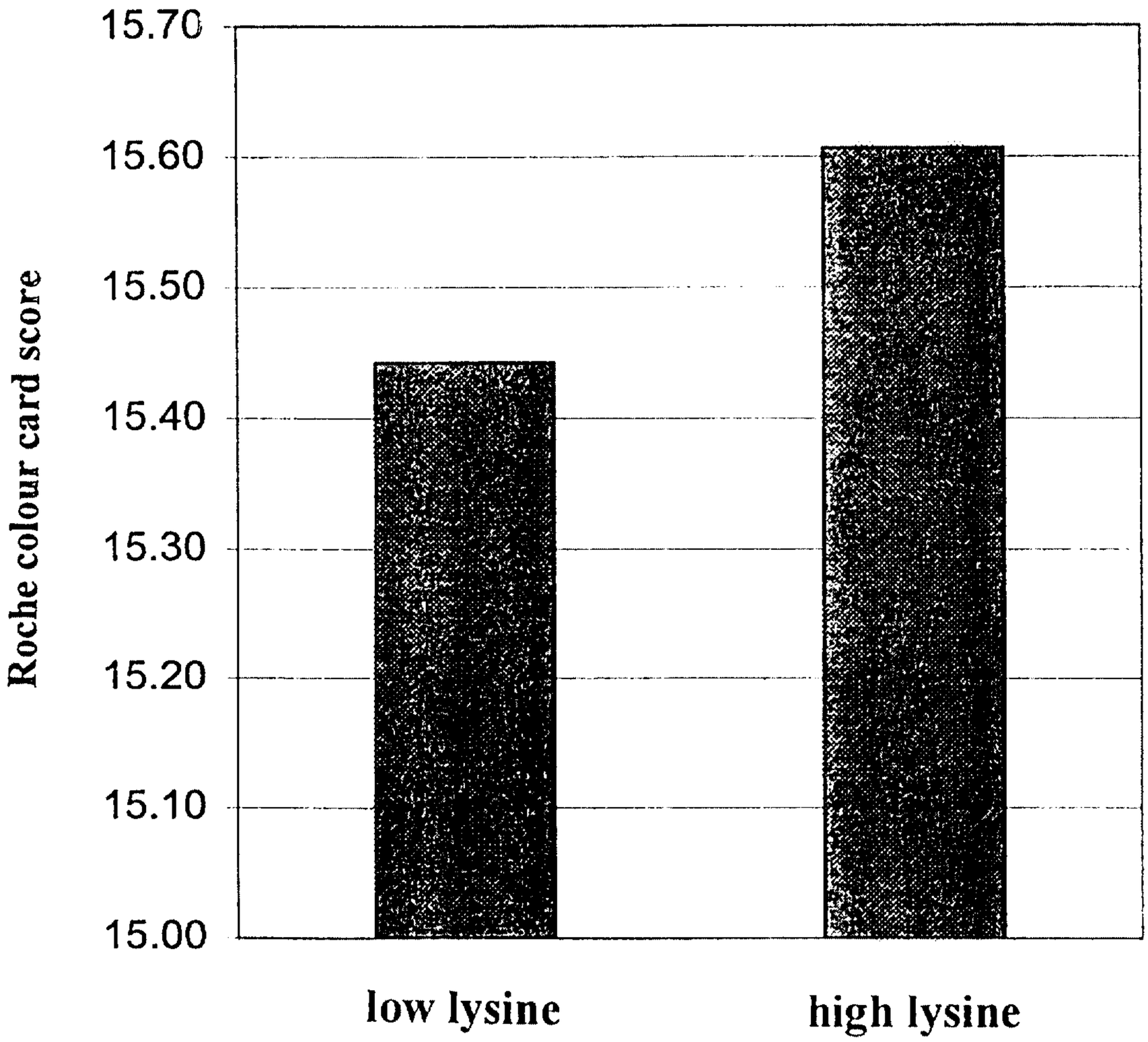

15.60
15.50
15.40
15.30
15.20
15.10
15.00
Roche colour card score
low lysine
high lysine

Figure 6


15.70
15.60
15.50
15.40
15.30
15.20
15.10
15.00
Roche colour card score
low lysine
high lysine