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## RIVO report

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## Consumer Perception of Wild and Farmed Cod and the Effect of different information conditions

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## Table of Contents:

Table of Contents: .....	2
Abstract.....	4
1. Introduction .....	5
2. Aims of the study.....	7
3. Pre-study .....	8
4. Design.....	9
4.1 Experimental groups .....	9
4.2 Independent variables .....	9
5. Experimental products .....	11
6. Dependent variables .....	12
7. Materials and Methods .....	13
7.1 Consumers.....	13
7.2 Experimental cod.....	13
7.2.1 QIM .....	13
7.3 Handling and distribution of the products .....	13
7.4 Preparation .....	14
7.5 Trial planning.....	14
7.6 Questionnaires .....	14
7.6.1 Expectations (pre consumption) .....	14
7.6.2 Experiences (post consumption) .....	14
7.6.3 Attitudes .....	15
8. Analyses .....	16
9. Results .....	17
9.1 Consumer panel .....	17
9.2 Cod .....	17
9.3 Pre consumption expectations (X) .....	18
9.4 Post consumption ratings (T) .....	19
9.5 Differences pre- and post consumption ratings.....	20
9.6 Modelling the relationships between pre- and post consumption ratings .....	21
9.7 Attitudes .....	22

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9.7.1 Fish consumption behaviour .....	22
9.7.2 Important aspects when eating fish.....	22
9.7.3 Important aspects when buying fish .....	22
9.7.4 Associations to wild and farmed fish .....	23
10. Discussion.....	24
10.1 Differences wild versus farmed without information .....	24
10.2 The influence of product information on product perception .....	24
10.3 Information about production type.....	24
10.4 Information about catching and "best before" dates .....	25
10.5 Information about quality control and price .....	26
10.6 Information about price and advantages of fish farming .....	27
10.7 Role of expectations in product perception .....	27
10.8 Attitudes towards product information aspects .....	28
10.9 Methodology .....	28
11. Conclusions.....	30
12. Practical recommendations .....	31
13. Recommendations for further research.....	32
13.1 Additional analyses with the current data .....	32
13.2 New research.....	33
14. References .....	34

Annexes and figures

## Abstract

The influence of product information on the consumer perception of fillets of wild and farmed cod was examined in a real in-home environment, in order to establish the external validity of these influences.

In several randomised full factorial experimental designs, MAP packed cod fillets were presented to approx. 1440 consumers of the Dutch TasteNet consumer panel to be assessed in their normal household situation. The products were presented over several sessions, one at a time. Product information was labelled on the package about production type (wild or farmed), quality control (independent or retailer controlled), price (high or low), catching date (short or long ago), remaining shelf life (short or long) and information on the advantages of fish farming (present or absent). A control with no-information at all except that the product was cod, was included in this study. Consumers gave their pre-consumption expectations and post-consumption experiences of the cod for overall and analytic (sensory) quality attributes.

Main effects in this study were observed for information about product type and for price. In contrast to the uninformed condition, cod that was believed to be farmed was judged less favourable compared to cod that was believed to be captured in the wild. Higher priced cod was generally rated more favourable than the lower priced cod. Extra (positive) information about fish farming showed no additional effect on product judgment, nor did catching date, shelf life information of the quality control.

Interaction effects of information with product perception prove to be robust. Even in a real life household situation there are significant interactions. Apparently, farming of fish is associated with less favourable characteristics and perceived as such, which has to be taken into account in the market focus.

## 1. Introduction

Cod production is an important factor for the Norwegian economy. According to FAO Statistics, in 2001 209 K tonnes of cod was landed in Norway, making Norway the second largest producer in Europe. At this time, only approximately 500 tonnes is being farmed (0.24% of the amount that is captured). Plans are to raise this production to 8000 tonnes in 2005. The relative share in total cod production will then be substantial, even more so considering the expected serious quota reductions for captured cod in most of the North and East European seas. In the market, however, the image of farmed fish is generally less favourable for farmed fish compared to fish captured in the wild (Kole, 2003). This might explain, for example, the structural difference in price for wild and farmed turbot being Euro 10/kg and Euro 9/kg respectively. For cod the existence of such price difference is unclear as farmed cod is not yet generally available throughout the European market.

First, the question can be raised whether this price hence desirability difference is justified when it comes to the mere sensory qualities of the fish, e.g. appearance, taste, smell, mouth feeling, etc. Secondly, according to modern consumer perception theories, the question can be raised what is the relative importance of such sensory differences in actual consumer perception of these products while buying and eating.

In the very few studies that have been published on the differences between farmed or farmed raised versus caught wild cod, hardly any overall sensory differences have been found (Solberg, 1989; Morkore, 2001; Carlehog, 2001). These studies using expert judgments do show there might be some analytical sensory differences between wild and farmed cod, especially relating to colour (whiteness) and firmness, but the data are not conclusively. Apparently the starving period before slaughter could be an important factor in determining sensory differences between farmed and wild caught cod. In a prestudy to this report, Luten et al. (2002) report similar results using nonexpert consumers, yielding the same incidental analytical sensory differences but no overall differences between farmed and wild cod in uninformed conditions. However, it could be argued that testing under uninformed conditions is not very realistic consumer product testing.

In real life situations, food products never come uninformed. Consumer decisions to buy and/or eat a food product depend on the perception of the different qualities of that product, which don't just comprise the taste of the product. Other factors like price, branding, package influence the perception of the product, along with taste. Indeed perceptual interactions have been shown between product taste attributes and product quality judgments, but also between taste attributes and product colour (Kole, 2001), between product price and branding and product quality judgments (Schifferstein 1999). Therefore, if the real market potential of farmed cod is to be investigated, it is unavoidable to explore the impact of the information that may accompany the cod on the market.

A second threat to valid consumer product testing is the external validity. Unlike in laboratory tests, in real life many of these information factors, like price, brands, storage data, nutritional data, production data come all together. Moreover, buying food and eating the food usually is not the single activity that consumers concentrate on at a time. In a daily life situation, it is easy to neglect or miss product information that otherwise might have influenced product perception. Therefore, to perform realistic and externally valid consumer product testing, such testing should not be carried out in a laboratory situation, but in the environment and under the conditions the consumers are used to consume their fish.

In this study we investigated how different product information influenced the perception of wild and farmed cod, when being consumed and judged in a normal home life situation. Information was given on production type, production date, shelf life, quality control and price. Studies at the Netherlands Institute for Fisheries Research (RIVO) have shown that many Dutch consumers feel they do not know a lot about fish (Kole 2001).

It was also shown that generally consumers have fairly strict convictions concerning the effects of production type (fish being caught or farmed) on the fish characteristics, both sensory (e.g. taste) and credential (e.g. healthy). Therefore, the impact of extrinsic information about the cod on product perception can be expected to be relatively large. Secondly, the progressing technologies in fish production (including farming), leads to an increased attention for the ways fish are produced across society hence in the media. Consumers may be expected to be fairly sensitive to information on production type, which is particularly relevant since from the beginning of 2002 according to EU regulations the production type has to be mentioned along with all fish products.

In this study, potential explaining variables were included at two levels. First, expectations data were collected on the individual level. From psychological theory, the concepts of 'framing' and the 'spread of activation' in the brain during perception, it can be hypothesized that expectations play an important role in determining product perception (Kole, 2000). For example, a higher price can lead to higher product expectations and thus result in higher product quality judgments. Second, data were gathered concerning the consumers' attitudes and beliefs toward a broad spectrum of issues related to fish production and consumption. As all consumers are not equal, attitudes and beliefs can influence the effect of information on product perception. These data can be used to study the effects for different groups of consumers. For example, it might be expected that for price conscious consumers, price information might affect product perception differently compared to price indifferent consumers.

## 2. Aims of the study

First aim is to study the sensory differences between the selected types of farmed and wild caught cod, without any extra information.

Second aim is to study the associations between the visual and semantic information provided and the product expectations this information evokes for different consumers

Third aim is to estimate the relative impact of several types of additional product information on consumer perception, as it occurs in the market.

Fourth aim is to study the intermediating role of expectations in explaining the interaction between non-tasting product information and consumer product perception.

Fifth aim is to be able to empirically discern different groups of consumers that might respond differently to the different information types, depending on their attitudes and beliefs towards fish and fish farming.

All testing should be performed under consumption circumstances that are as realistically as possible, in order to obtain good external validity of the results.

### 3. Pre-study

As it was mentioned before, a pre-study has been carried out preparing for the current study. This study using approximately 1000 Dutch consumer from some 400 households showed very little differences between cod samples (wild versus farmed) or cod type labels (labeled "wild" versus "farmed"). The results of this pre-study have been reported elsewhere (Luten et al, 2002). The results of this pre-study led to several adaptations in the current design and methods in order to improve the discriminative power of the study. The size of the questionnaires was severely reduced to a maximum of 16 items in order to avoid boredom and indifference in scoring by the consumers. Also, the bipolar scales were replaced by unipolar intensity scales as they are semantically slightly easier to use. In the pre-study products were presented in-home in pairs, with the instruction to consume them on two consecutive days. This is not a very realistic practice. It may induce carry-over effects from one product to another. In the current study products were presented one by one, separated at least by a period of two weeks.



## 4. Design

### 4.1 Experimental groups

In this study it was the aim to know whether consumers expect or experience differences between farmed and wild cod, as well as the interaction of product information with product perception. Four groups were randomly selected, each testing six (group A, 2x3 full factorial design) or four (groups B, C and D, 2x2 full factorial design) product-information combinations, within subjects (Table 1). Hereafter, the combination of a portion of cod in combination with an information label is referred to as an 'experimental product'.

### 4.2 Independent variables

In group A, 400 consumers were selected to test 6 product-information combinations: farmed and wild cod with either no specific production type label ("Cod"), with a label "Farmed cod" or labelled "Wild cod" (group A, Table 1).

In order to gain more insight in which knowledge influences the consumers' expected and experienced qualities, three additional groups of 400 consumers were selected. These three groups received **farmed cod each session**, in combination with a combination of two information types. Each group in this way received 4 different product-information combinations, i.e. 1 product type (farmed cod) X information type 1 (2 levels) X information type 2 (2 levels) (groups B, C and D, Table 1).

Group B received information on the catching date of the cod, in combination with a "eat before" indication (group B, Table 1). Information that a long time had passed since the cod was caught was operationalized as being caught *five* days before receiving the product. Information that a short time had passed since the cod had been caught was operationalized as being caught *one* day before receiving the product. Products that could still be kept for a long period showed an "eat before" date, dating five days from the date the product was received by the consumer. Products that could only be kept for a short period showed a "best before" date, dating only three days from the receiving date, to allow some time before the fish should be consumed.

Group C received information about the institution in charge of the quality control of the product, in combination with information about the price of the cod being either higher than average (average Euro 17.50/kg, higher price +9%: Euro 19.10/kg) or lower than average (- 9%: Euro 15.90/kg). The controlling institutions were an independent agent, in this case the Netherlands Institute for Fisheries Research, and an involved agent, in this case represented by an imaginary retailing supermarket chain (group C, Table 1).

Group D received information on the advantages of fish farming practices, combined with price information (either higher or lower than average). The information on 'farming practices' was either present or absent. The label contained the following information:

Farming fish has several advantages:

- Safety: Control of feed and water.
- Fresh: Delivery directly on demand.
- Environment: Doesn't disturb sea environment.
- Sustainable: No over-fishing.
- Animal friendly: The fishes are good taken care of.

The detailed information on the corresponding product labels and the information they contained are summarized in Annex 1.

*Table 1. Overview of the experimental groups. Group A subjects judged 6 product-information combinations (2x3), the other groups judged four product-information combinations (1x2x2)*

Information	Levels	Condition groups			
		A	B	C	D
Actual cod	Farmed Wild	+			
Label	No production type "Wild", "Farmed"	+			
Eat before	Long (5 days) Short (3 days)		+		
Since catch	Long (5 days) Short (1 day)		+		
Price	High Low			+	+
Quality control	RIVO Retailer			+	
Farming info	Present Absent				+

It is known that attitudes of consumers influence their expectations and product perception. Little is known about consumer attitudes with respect to fish and fish farming related issues. Based on former trials, an attitude questionnaire was developed to be able to relate results of this study with consumer segments. This questionnaire was handed out after the in-home study to the consumer panel.

#### *Presentation order*

The presentation orders of the experimental products were completely balanced for groups B and C. In group A, for all subjects, the first two experimental products were wild and farmed cod without extra information on production type (orders balanced). After that, the presentation order of the remaining four experimental products was equally balanced over subjects. In group D, for all subjects the two products with extra information about the advantages of farming would come last. Apart from this restriction the presentation orders were equally balanced over subjects.

## 5. Experimental products

The households received several products together with different information about the product. The product consisted of a MAP packed portion of fresh chilled cod fillet and a sticker on the package with the relevant information. The sticker always mentioned "Cod". Besides this, other information about, for example, the type of production could be added. This label information was also present on the questionnaire.

Furthermore, the sticker contained an "eat before" date, a recommended storage temperature of 0-4°C, and a preparation instruction ('fry in pan').

## 6. Dependent variables

All experimental products were tested pre-consumption (expectations, X), as well as post-consumption (trial, T). Basically three types of attributes were questioned, on seven points intensity scales, ranging from "not at all" (0) to "very much" (6).

1. Analytical attributes, questioning basic neutral sensory aspects irrespective of their preferential level, like fatty, lean, dry, firm, juicy, tender, flabby, and fishy.
2. Holistic attributes, questioning overall evaluative constructs with a strong affective connotation, like quality, attractive, pleasant.
3. Credence attributes, questioning product properties that in fact cannot necessarily be perceived, like freshness, fatty, healthy, lean.

The attributes 'lean' and 'fat' were questioned two times. The first time in the context of credence attributes, to be judged when the cod was in the package and before preparation. The second time these attributes appeared in the context of sensory attributes, referring to the actual analytical attributes fatty and lean after preparation. The attributes are called 'lean1' and 'fat1' versus 'lean2' and 'fat2', respectively.

Next, all experimental products were tested post-consumption for the attributes mentioned above. A subjective judgment of overall expectation disconfirmation was requested. This judgment refers to the extent subjects felt their pre-consumption expectations got confirmed or disconfirmed. Additionally, an explicit overall satisfaction judgment was requested.

More details about the questions that were used in each phase of the study are presented in paragraph 7.6. Questionnaires.

## 7. Materials and Methods

### 7.1 Consumers

For this study 1440 (from 606 households) consumers were randomly selected from TasteNet. TasteNet is a Dutch consumer panel, organized by The Netherlands Institute for Fisheries research within the Wageningen University and Research organization (WUR). The consumers were selected on the following criteria: 12 years or older, no allergy for fish or fish products, no dislike for fish or fish products. The consumers were average 38,5 years old and 48% were male. The majority of the selected households were 'two persons without children' with double incomes, average between 2040 and 2720 euro per month per household. The majority of the selected consumers finished higher education or university.

### 7.2 Experimental cod

The raw material for this study was obtained from a cod farm in Norway. This cod has been farmed from the juvenile stage. The wild cod was obtained from an Icelandic supplier, Tros ehf. Both types of cod were handled according to the suppliers in-home procedures. During every trial the same procedure has been followed. The farmed cod was harvested and slaughtered on Thursday, sent to the Netherlands by truck on Saturday and arrived in the Netherlands on Sunday evening or early Monday morning directly at the processing plant. The wild cod was bought in Iceland, caught preferably on Thursday and sent by plane on Saturday to the Netherlands. The cod was collected at Schiphol Airport at the same day of arrival and stored afterwards at RIVO until Monday, the day of further processing.

The fish processing plant Seafood Partners carried out the processing and packaging of the cod. The cod was filleted, skinned, deboned and cut in pieces of average 150 grams. The individual pieces were packed in modified atmosphere (MAP) with a gas mixture of 30% carbon dioxide and 70% nitrogen. The packages were blue with transparent top sealed foil, like commercial practice. The white label (7x9 cm) was printed with black text, placed at the side of the package. The label contained the same information as the labels on the questionnaires.

#### 7.2.1 QIM

To be sure of the relatively constant quality of the cod throughout the experiments, every trial the cod was assessed on freshness with QIM. Prior to processing, 5-7 RIVO QIM panellists assessed the cod using the QIM-scheme for cod (Martinsdóttir et al 2001). Per batch randomly three fishes were selected and stored on ice during the assessment period of 30 minutes.

### 7.3 Handling and distribution of the products

After the cod has been processed and packaged the products were stored overnight at RIVO at 2-4°C. On Tuesdays the products were collected for each household. For each household a polystyrene box was prepared containing a freezer pack, one package of cod per person, an instruction form, one set of questionnaires per person and envelopes. The boxes were labelled with the name of the household and transported Tuesday afternoons to six distribution points from where each household could collect the box the same day.

## 7.4 Preparation

The consumers were requested to read the instructions first. In these instructions the consumers were asked to prepare the fish by frying only, without using strong spices or sauces. The products needed to be stored prior to preparation in the refrigerator.

## 7.5 Trial planning

The consumers received one cod sample at a time for four or six times. The trials were performed between November 2002 and February 2003. Catching and slaughtering dates are mentioned in table 2. Trial 5 and 6 (23 January and 20 February) only were performed in group A.

*Table 2: The planning of the six trials of the cod in-home consumer study.*

Trial 1	Trial 2	Trial 3	Trial 5	Trial 4	Trial 6
07-nov	05-dec	09-jan	23-jan	06-feb	20-feb

The attitude questionnaire was handed out at the 6<sup>th</sup> of May 2003, in order not to disturb the product testing by possible learning effects from the (extensive) attitudes list.

## 7.6 Questionnaires

### *7.6.1 Expectations (pre consumption)*

The questionnaire about expectations of the product was handed out directly with the product. The cover page of the questionnaire contained a label with the same information as on the package of the delivered product. Consumers were requested to fill out this questionnaire as soon as possible after reception, without opening the package. They could use the information on the label to make up their impression of the cod. First their impression was asked about the cod in the package (quality, freshness, attractive, fat1, healthy and lean1). Then their expectations were asked of the cod after preparation (pleasant, dry, fat2, firm, juicy, lean2, tender, flabby, and fishy taste). The consumers were asked to put the questionnaire in an envelope after they have filled it out and to close the envelope (see Annex 3).

### *7.6.2 Experiences (post consumption)*

After preparation and eating the cod fillets, the consumers filled out the second questionnaire. First their impression was asked after they have consumed the cod in relation to the attributes: quality, freshness, attractive, and healthy. Secondly they were asked to give their opinion on sensory aspects of the product (pleasant, dry, fat, firm, juicy, lean, tender, flabby, fishy taste). Although consumers were requested to fry the cod in a pan, it was checked by asking how they actually prepared the cod. Finally two overall opinions were asked: "Did the fish meet your overall expectations" (disconfirmation), and "Are you overall satisfied with the product" (satisfaction) (see Annex 4).

### 7.6.3 Attitudes

After the experimental trials, the consumers received the third questionnaire, on attitudes. The attitude questionnaire handled aspects on

- ?? Fish consumption related behaviour, like fish consumption frequency, where they buy fish, past and expected changes in their fish consumption behaviour.
- ?? The importance of fish and fish farming related issues, like price, quality, safety, environmental aspects. These aspects were rated on 5 point scale from 'not important at all' to 'very important'
- ?? What consumers do pay attention to when they buy fish. Ten aspects needed to be rated in order of importance.
- ?? The association of several related issues either to wild or farmed fish. These issues were rated on a 9 points scale from 'mostly associate to farmed fish' to 'mostly associate to wild caught fish'

For detailed information see Appendix 2.

## 8. Analyses

All statistical analyses were performed with SAS Software, release 8.1.

To study the sensory differences between the selected types of farmed and wild captured cod without any extra information, within group A analysis of variance was performed on the ratings for wild and farmed cod, without any extra information, using production type (wild/farmed) and subjects as independent factors. These ratings are called the 'blind' ratings [B].

To study the associations between the information that was provided and the product expectations this information evokes for different consumers, analyses of variance were performed within each group. For these analyses information types and subjects were independent factors, the pre consumption expectation ratings [X] dependent variables.

To estimate the relative impact on consumer perception of several types of additional product information, as it occurs in the market, within each experimental group analyses of variance were performed on the ratings of all product-information combinations after trial [T], with subjects and information types as independent factors.

The presentation of the results of the analyses of variance hereafter focuses on results that are both statistically significant as well as visible in the figures.

To study the intermediating role of expectations in explaining the interaction between non-tasting product information and consumer product perception, regression analyses were performed within each group. Basically the models aim to explain post consumption perception T (Trial), by pre-consumption expectations that are based on the information (X), and the basic judgments of the cod fillets without any extra information (B):  $T = d + aX + bB + cBX$  (Annex 6). As only group A has tested the products without additional information on the label, for group B, C, and D the models are of the form  $T = c + bX$ . These models were tested for statistical significance for each product-information combination, for each attribute. The explaining power of the models is expressed through (adjusted)  $R^2$  values.

To empirically discern different groups of consumers that might respond differently to the different information types, attitudes and beliefs towards fish and fish farming were measured. Frequency analyses show the spread of attitudes and beliefs within the total sample. Together these give an indication of the groups of consumers that might be discerned with respect the other (perceptual) analyses.

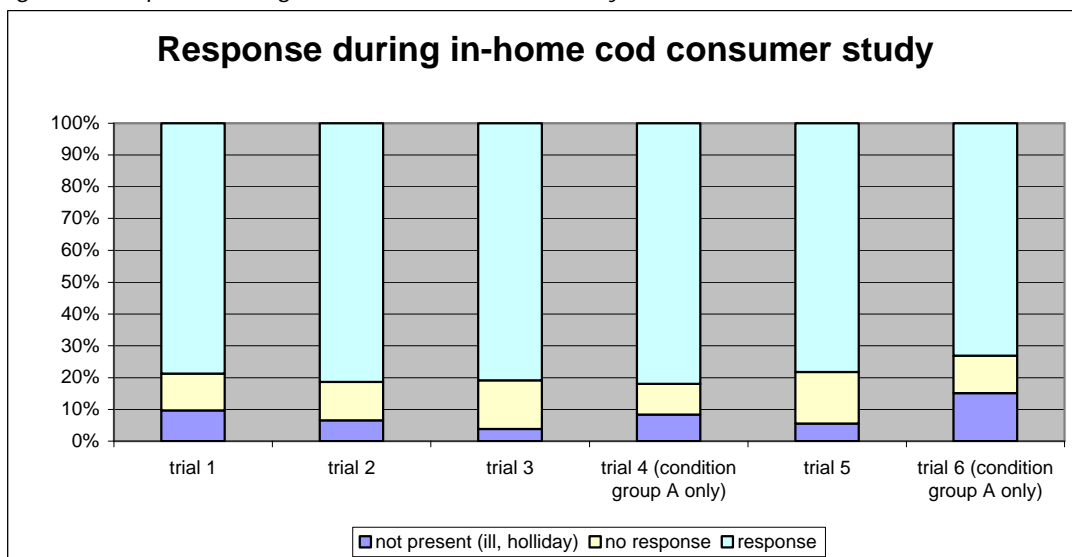


## 9. Results

### 9.1 Consumer panel

The response of the TasteNet consumers was high, 80% of the consumers returned the questionnaires. Responses for each trial are shown in Figure 1. The profile of the responded consumers has not changed in comparison with the selected consumers.

Figure 1. Response during in-home cod consumer study.



### 9.2 Cod

Before the project started the project team was concerned about the spawning season of the cod, giving low quality fillets as well as inhomogeneous samples during the project. It was decided to buy Icelandic wild cod instead of North Sea cod as lower seawater temperatures postpone the spawning season. Due to the spawning season, the farmed cod came from another batch at the fourth, fifth and sixth trial but from the same farmer. These fishes were smaller sized. The size of the wild cod fillets has been adapted accordingly for these trials. Although much effort had been taken to obtain a homogeneous size of cod throughout the project, the size of the cod varied between and within trials, for wild cod as well as for farmed cod. Especially at the third trial (13-01-03) the farmed cod varied considerably in size. So first three trials sizes of cod 3 kg gutted head on, second three trials 2 kg gutted head on. During the processing and packaging of the cod some remarks were made by research assistants: for farmed cod, sometimes broken spines, just behind the head were present, there were black spots in the fillets from farmed cod and the 'loose segments' of the raw fillets of farmed cod. In the wild cod nematodes were present in the fillets. Wild cod for the last trial contained less meat than in the other trials.

The Quality Index of the cod varied between 2 - 7 for farmed cod and 5 - 8 for wild cod (Table 3). These QIM results of farmed cod correspond with a freshness of 2 to 6 days in ice and for wild cod it corresponds with a freshness of 4 to 7 days in ice. The actual freshness at the moment of assessment was 4 days. The observed freshness was appropriate for this study.

Table 3. QIM results raw material cod in-home consumer study.

Trial	Farmed				Wild			
	Fish 1	Fish 2	Fish 3	Average	Fish 1	Fish 2	Fish 3	Average
1	7.7	5.3	5.3	6	6.4	4.3	5.9	6
2	1.8	3.8	4.8	4	7.8	9	8.2	8
3	4.9	6.5	6.9	6	5.8	6.6	6.8	6
4	4.7	8.6	8.4	7	5.4	6.0	5.1	5
5	4.0	4.3	6.8	5	4.7	6.0	4.0	5
6	2.2	1.8	1.2	2	6.7	10.0	-	8

### 9.3 Pre consumption expectations (X)

#### Group A

Two types of fish were tested in group A: wild and farmed cod. The products were labelled either: "cod", "farmed cod", "wild cod". The expectations of the product are triggered both by the cod in the package, as well as the information on the package label.

Figure 2 shows that the expectation ratings for the wild cod, labelled "wild cod" are highest: higher rates for quality, attractive, pleasant, freshness, healthy, lean, juicy and tender. Expectations are lowest for fatty, dry and fishy taste.

The results of the analysis of variance (Table 4) show that the effects of information ("cod", "farmed cod" and "wild cod") on the expectations of the product over the three labels are significant for all the attributes except for lean and firm. "Farmed" labelled cod (wild and farmed) yields more negative expectations.

There is a significant main expectations effect for production type (wild – farmed) over production type label information. The analyses show significant lower ratings for farmed cod with respect to quality, attractive, pleasant, freshness, healthy, dry and tender. Separate analyses show, however, that the expectations for the mere products (wild and farmed) without product type information are similar, except for the attributes firm and flabby. Without additional information, the wild cod is expected to be less firm and flabbier.

#### Group B

In group B four different experimental products were tested. All products were farmed cod, the label provided two types of freshness information, i.e. the "date of catch" and an "eat before" date, each at two levels. The labels indicated either "caught one day ago, to be consumed within three days", "caught five days ago, to be consumed within three days", "caught one day ago, to be consumed within five days", or "caught five days ago, to be consumed within five days".

The mean expectations (Figure 3) are practically the same for the four experimental products, except for the attributes 'fresh' and 'fishy'. Expectations based on the label indication "caught one day ago" were significantly higher for 'freshness' (main effect of perceived time since catch). Consumers expect that cod that was caught one day ago is fresher than cod that was caught five days ago.

"Eat before" information affects expectations only significantly for the attribute fishy, consumers expecting the cod to be more fishy when it is indicated "to be consumed within three days", compared to "to be consumed within five days" (Table 5).

#### Group C

In group C four experimental products were tested, consisting of farmed cod combined with label information "price" and "controlling agent". The four information combinations were "price below average, controlled by the retailer", "price below average, RIVO controlled", "price above average, controlled by the retailer" or, "price above average, RIVO controlled".

Figure 4 shows that there are only minor differences between the expectations for the four products. Expectations are significantly higher for products labelled with a high price, for the attributes quality, attractive, pleasant, fresh, healthy, juicy, and firm (Table 6). Although statistical significant, the absolute differences are minor. Information about the quality-controlling agent did not affect consumer expectations at all.

#### Group D

In group D four farmed cod products were tested under the label "farmed cod" with in addition label information about "price" and about "potential advantages of fish farming". The potential advantages of fish farming that were mentioned on the label:

- Safety: Control of feed and water.
- Fresh: Delivery directly on demand.
- Environment: Does not disturb natural sea environment.
- Sustainable: No over-fishing.
- Animal friendly: The fishes are good taken care of.

The four information conditions were: "farmed, price below average", "farmed, price above average", "farmed, price below average, positive farming information" or "farmed, price above average, positive farming information".

Figure 5 shows that a price above average yields slightly higher expectation rates for the majority of attributes. Expectations are significantly different for the attributes quality, attractive, pleasant, fresh and lean. Cod labelled farmed and with a price above average is expected to rate higher on these attributes. The highest expectation rates are for the experimental product labelled "farmed, price above average" (Table 7).

Main effects of the fish farming information on expectations are significant for the attributes 'fishy' and 'lean'. The products with positive information farming on the label are generally expected to be less fishy and lean (Table 7).

## 9.4 Post consumption ratings (T)

#### Group A

After preparation the cod was consumed and questions were answered. If the consumer has no information about the production type they have been eating (labelled "cod") then the farmed cod is experienced to be of a higher quality, more attractive and pleasant, more fresh, more healthy, more dry, more firm texture and overall more satisfying (Figure 6).

Figure 7 shows that if consumers have information about the production type on the label then the wild cod labelled "wild" and farmed cod, labelled "wild" gave the best ratings. It is clear that cod products with label "farmed" were rated lower on quality, attractive, pleasant, freshness and healthy. For the sensory attributes (e.g. juicy, firm, etc.) the effect of the production type label is less pronounced. In case of the attributes fat and lean no difference between the six products are observed. The three wild cod products (labelled "cod", "wild cod" and "farmed cod") are less dry, less firm and more flabby then the farmed type products, regardless the label on the package (Figure 7).

The results of the analysis of variance (Table 8) show that the effects of information ("cod", "farmed cod" and "wild cod") on the post consumption ratings of the product over the three labels are significant for all the attributes except for fatty, lean and flabby. "Farmed" labelled cod (wild and farmed) yields more negative experiences.

There is a significant main post consumption effect for production type (wild – farmed) over production type label information. The analyses show significant higher ratings for farmed cod on attractive, dry and firm but lower ratings on juicy, flabby and tender.

### Group B

Figure 8 shows that there is no visual difference in the post consumption ratings (T) between the four products labelled with two types of freshness information, i.e. the "date of catch" and an "eat before" date. Consumers did not experience any significant difference between the products with an indication on the time since catch ("caught one day ago" and "caught five days ago"). "Eat before" information affects the post consumption ratings only significantly on fishiness. The product labelled with "eat within three days" is experienced to be slightly more fishy (Table 9).

### Group C

The four products in group C were labelled with information on the price (below average and above average) and on the controlling agent ("RIVO controlled" and "controlled by the retailer"). Figure 9 shows the post consumption experiences (T) for the products in this group. The post consumption ratings are significantly higher for products labelled with a higher price, for the attributes quality, attractive, pleasant, fresh, healthy and tender (Table 10). Information about the quality-controlling agent did not significantly affect post consumption experiences.

### Group D

Figure 10 shows the results of the post consumption ratings (T) for the products in group D. These four products were all labelled as "farmed cod" with additional information on price (below average and above average) and on advantages of fish farming (present or absent). Products labelled with a "price above average" rate significantly higher on attributes quality, attractive, pleasant, fresh, firm, juicy and tender and lower on dryness (Table 11). The main effects of the fish farming information on post consumption ratings are significant for quality, attractive, pleasant, fresh, healthy, fat, dry, firm and flabby. The product without positive information on farming is rated higher for attributes quality, attractive, pleasant, fresh, healthy and firm (Table 11).

## 9.5 Differences pre- and post consumption ratings

### Group A

The differences between pre and post consumption ratings are shown in Figures 11 to 16. For each product (wild and farmed type products labelled with "cod", "farmed cod" and "wild cod") the results for pre consumption (X), post consumption (T) and 'blind' (B, the post consumption ratings of production type farmed and wild, labelled as "cod") are shown in one figure and calculated (B-X, B-T, X-T) in Annex 5 (significant results only). The blinds represent the influence of fish type on the post consumption ratings and the influence of label information is represented by the expectations. For the wild type product labelled "cod" (Figure 11) the expectations are based on the type of product only and what consumers know about the product cod. From the results it is clear that expectations (X) are almost similar to the post consumption ratings (T), except for the attributes flabby (T higher than X), firm and fishy (X higher than T). For the farmed type product labelled "cod" (Figure 12) this is different. The expectations on attractive, fresh, dry and lean are lower than the post consumption ratings (X lower than T). The farmed type product with no label is rated more positive than expected. For the farmed type products labelled "farmed cod" and "wild cod" (Figure 13 and 14 respectively) the trend in pre consumption versus post consumption ratings are similar. Both products are rated significantly more positive than expected on the attributes attractive, pleasant, quality, fresh, healthy, dry and firm. For the attributes fat, fishy and juicy the ratings are lower than expected. The effect of information on the post consumption rates of farmed type cod labelled "farmed cod" is significant for the attributes pleasant, quality, fresh and juicy (B-T is significant and positive in results Annex 5). For the wild typed cod products labelled "farmed cod" and "wild cod" (Figure 15 and 16 respectively) the post consumption ratings are significantly lower as expected for the attributes firm and fishy and higher as expected for 'flabby'. The other attributes show no difference between pre and post consumption ratings. The effect of information on the post consumption rates of wild type cod labelled "farmed cod"

is significant for the attributes pleasant, fresh and juicy (B-T is significant and positive in results Annex 5).

### Group B

Figures 17-20 show the differences between pre consumption and post consumption ratings. There is only significant effect for the attributes attractive, quality, healthy, dry, firm and fishy for almost all four products (X-T results in Annex 5). In general the post consumption ratings are higher than expected the exception on this is the attribute fishy, what is always rated lower than expected. There is rarely an effect of information (B-T results in Annex 5) for all four products.

### Group C

Figure 21-24 show the differences between pre consumption and post consumption ratings. For the product labelled with "low price, retail controlled" there is no difference between pre and post consumption ratings (X-T in annex 5). For the other three products the post consumption ratings are higher than expected ( $X < T$ ) for the attributes attractive, pleasant, quality, fresh, healthy, dry and firm. There is an effect of information ( $B < T$ ) for the product labelled "high price, retail controlled" (for the attributes pleasant, and healthy only). For the product labelled "low price, retail controlled" (for the attributes attractive pleasant, quality, fresh, tender and flabby) the post consumption ratings are lower with information on the label than without information on the label ( $B > T$ ). For the products labelled "high price, RIVO controlled" and "low price, RIVO controlled" there is no difference between ratings of products with or without information on the label ( $B = T$ ).

### Group D

For all four products in group D (Figures 25-28) there are similar relations between pre and post consumption ratings. The results in Annex 5 show that the attributes attractive, quality, fresh, healthy, dry and firm are rated higher than expected ( $X < T$ ) for the products labelled "farmed, low price", "farmed, high price" and "farmed info, low price". The attributes fat, fishy, juicy, tender and flabby show significant lower ratings for post consumption than expected for almost all four products ( $X > T$ ). The differences between products with and without information (B-T) are small if any, except for the product labelled "farmed info, low price" on the freshness where the product with information is rated much lower than without information.

## 9.6 Modelling the relationships between pre- and post consumption ratings

Annex 6 shows all the results of the models that aim to explain post consumption perception T (Trial), by pre-consumption expectations that are based on the information (X), and the basic judgments of the cod fillets without any extra information (B, only group A):  $T = c + bX + aB + dBX$ . For group B, C, and D the models are of the form  $T = c + bX$ . These models were tested for each product-information combination, for each attribute. Annex 6 columns show respectively the experimental products, attributes, significant parameter values for expectations X, post consumption ratings without information B (only group A), interaction term BX, explaining power of the model, and the significance of the model.

In all groups the pattern is more or less alike. Most of the models are clearly significant ( $p < 0.001$ ). In group A, the interaction effects (XB) contribute marginally (when significant, parameter values ranging between 0.04 to 0.17) or not at all. These interaction parameters can thus be ignored when interpreting the models.

The results show that the models differentiate for attributes, not so much for product-information combinations. Generally the same attributes show the same pattern in contributing to the regression models, irrespective of the experimental groups (type of cod, type of information). In particular for the attributes fat, fishy, fresh, healthy, lean, and quality the models show explaining power (adjusted  $R^2$ ) ranging between 0.25 and 0.45. In these models, the expectations contributing significantly, showing parameters around 0.50 (0.40 to 0.75).

From the parameter values in columns 'X' and 'B' it can be seen that the uninformed product ratings (B, group A only) never contribute more to the post-consumption rating of the experimental products (T) than do the expectations that are based on the information (X).

For most attributes, the (adjusted)  $R^2$  values for the models show that generally explanation of T by X and B in group A is better than in group B, C and D (higher  $R^2$  for group A).

## 9.7 Attitudes

### 9.7.1 Fish consumption behaviour

In Figure 29 the results of the fish consumption pattern are presented. This figure shows that 81% of the respondents eats fish at least once a month. From this group 32% eats fish once a week or more. Most of the consumed fish is bought at the supermarket (48%). Twenty four percent is bought at the fish shop, and 21% at the local market (Figure 30). When eating out of home on the average approximately three out of ten times fish is selected as the main course (Figure 31).

Approximately 33% of the respondents replied that the quantity of fish consumed has increased during the last year (Figure 32). About 25% of the respondents expects that the quantity of fish they will consume next year will increase (Figure 33). Half of the participants usually do the (fish) shopping.

### 9.7.2 Important aspects when eating fish

In Figure 34 the importance of a number of aspects related to *eating* fish is shown. In general the consumers think that all mentioned aspects are of importance and rate them from 3 'neither important nor unimportant' to 5 'very important'. The aspect taste is the most important (average rating 4.5). Some aspects can be grouped in one theme. The grouped aspects on product safety being contaminants (PCB's, heavy metals, dioxins, hormones and antibiotics) safe product, healthy and health risks are considered important to very important (average rating 4.3). The quality aspects (freshness, quality, best-before-date, shelf life) are considered to be important (average rating 4.3). Reliability aspects (quality label, reliability of retailer, ease to judge quality) are considered to be slightly less important (average rating 3.8). The aspects related to 'sustainability and welfare' (careless life for the fish, environmental friendly label, natural life for the fish, stress, animal friendly production, environment friendly production, farmed or wild) are considered 'neither important nor unimportant' towards 'important' (3.4 on scale of 5). The aspect price is with an average rate of 3.8 regarded as important.

### 9.7.3 Important aspects when buying fish

In Figure 36 the importance of a number of aspects related to *buying* fish is shown. The consumers pay the most attention to freshness and taste of the fish. Minor attention is paid to the place of origin (where the fish has been caught) and the production method (wild or farmed). Moderate attention is paid to price, shelf life and reliability of the retailer. When buying fish, shelf life is more important than day of catch and reliability of the retailer is more important than reliability of the producer. This was also reflected in the previous question on the importance of aspects when eating the fish.

#### *9.7.4 Associations to wild and farmed fish*

Figure 36 shows that wild fish is thought to have a more natural life, to be free of contaminants like antibiotics, hormones and colorants. On the contrary farmed fish are regarded as free of environmental contaminants like PCB's, heavy metals and dioxins. Wild fish is a more expensive and luxurious product with good taste and quality. Farmed fish is considered a well-controlled and safe product (regardless the hormones, antibiotics and colorants) with a long shelf life. Notwithstanding these positive aspects about farmed fish, fish that is produced in farms is associated with lower retail prices.

Wild fish is thought to be produced both environmentally friendly and animal friendly.

Contradictive results are that farmed fish is thought to have a long shelf life but that wild fish is fresher.

## 10. Discussion

### 10.1 Differences wild versus farmed without information

In line with former results (Luten et al., 2002) differences between the unlabelled farmed cod and the wild cod that were used in this study were not very large. The main differences were of analytical sensory nature, the farmed cod being somewhat firmer and drier. This study also confirms the former one in that the type of production doesn't lead to substantial differences in perceived overall quality or appreciation when looking at the figures. For all overall hedonic attributes the differences are in favour of the farmed cod, but the differences are not significant. Important to note is that the current study deals with consumer perceptions. The results in this study indicate that under normal daily life circumstances and without any additional information, consumers did not perceive much overall quality difference in appearance or taste between the farmed and wild cod that were used. These results do not mean that expert judges wouldn't be able to perceive more differences, or that the consumers wouldn't be able to perceive more differences under different circumstances. Therefore the results are not necessarily in contradiction with test results that did show different perceptions.

### 10.2 The influence of product information on product perception

Based on these results that consumers do not perceive differences between unlabeled wild and farmed cod a difference in market price between the two types of cod would not be justified. However, as it was remarked before, in daily life products don't come alone. Food products in the market are always accompanied by information and together with that information they form an inseparable perceptual whole.

Indeed, this study shows that the perceptions and evaluations of the products with different information's added deviates substantially from the experimental products where this information is lacking. In other words, it proves that even under in-home circumstances generally consumers evaluate the same physical products differently according to the information that is attached to it. From this point of view, the information can be considered an extrinsic characteristic to the product, or an added value. This is an important notion, as these extrinsic characteristics add considerably to the overall perceived quality of the products and through this, to its economical value.

### 10.3 Information about production type

However, according to this study, not all information adds to this effect. The results show that in particular 'price' and 'production type' information influence consumer product perception. The importance of the information label is obvious when considering the effects of 'production type'. The main effects are holistic in nature. The production type labels made the products to be perceived differently on overall evaluations like quality, attractive and healthy, whereas the absence of a label only led to main differences on analytic sensory attributes. Clearly, a main effect is found that products labelled "farmed" were evaluated less good compared to "no label" or "wild labelled" products. This indicates negative associations with the "farmed" label. This is confirmed by the pre consumption expectations that also show more negative expectations in reaction to the products labelled "farmed". Farmed type cod labelled "farmed" is expected to be of less good quality, the least attractive, pleasant, fresh, healthy (holistic attributes), the least lean, juicy, tender, and the most fat and dry (analytic attributes).



That these evaluations are derived from a general poor image might be concluded from the fact that from a sensory point of view, the expectations do not seem very consistent, as most fat and most dry is not a realistic sensory combination nor is the combination of most fat with least juicy and tender.

From the results (Figure 7) it is clear that also post consumption overall judgments are affected most by the label "farmed". The products labelled "farmed" are perceived as not so good (e.g. quality, pleasant), whereas for the sensory analytic ratings the actual type of cod (wild / farmed) affects ratings more than the production-type label (e.g. dry, firm, flabby). Apparently, the analytic attributes connect more to the actual product tested, albeit in interaction with the information label, whereas the information label exerts its strongest effects on the holistic quality judgments. It suggests that the information effect is not always as straight forward and may be more complicated than anticipated. It is likely that consumers mainly make their choices based on overall impressions and evaluations (unless they look for some specific feature), and the production-type label appears an important cue in that overall evaluation.

#### 10.4 Information about catching and "best before" dates

From a food science perspective, freshness of fish is generally acknowledged as being very relevant to overall quality. Accordingly, in the attitudes questionnaire, consumers indicated freshness to be the most important aspect at buying fish and among the most important aspects when eating fish. Surprisingly, the freshness labels that were used in this consumer study did not affect product perceptions a lot. Indications of the "time to go to consumption" didn't show any effects in expectations. A "short time since catch" indication cued more expected freshness. "Long since catch, short to go", really the combination of information that represents the least fresh fish, raised expectations of a more fishy taste. The finding that no effect occurred on overall expectation might be an indication that for consumers there is no direct link between freshness indications and specific (sensory) properties that may lead to an overall quality judgment. This contradicts the usefulness of freshness as an overall quality indicator for consumers, and it may be too difficult for them to relate the freshness indications to specific analytical attributes that may or may not be favourable. Several reasons could be involved in the lack of effects. First, the way the freshness information was presented was too difficult to understand and/or required too much calculating by the consumers. They may not have wished to spend this much effort on the information and may have ignored it all together. Alternatively, or even additionally, the confidence in the supplier of the fish may have been so high that the consumers didn't feel any need to suspect the fish not to be fresh. This conviction would not be motivating to elaborate on the information. From these results it becomes not clear whether the information was too difficult to understand or neglected. The fact that the information of "short time since catch" did yield significant effects for expected 'freshness', may indicate that the subjects are willing to use the information, but were not able to derive more from it than a freshness indication. To use this cue to add value to farmed or wild cod would require more analytical knowledge from consumers to interpret, or a better way of presenting the information.

The general belief that freshness is an important cue for overall quality might be another sign that this however is important information for consumers, worth considering any data cueing freshness. However, qualitative research at the RIVO has shown that (Dutch) consumers (Kole, 2001) actually do not feel themselves comfortable in judging these type of qualities in fish, probably due to a lack of experience.

## 10.5 Information about quality control and price

The same qualitative research mentioned above, showed that consumers like to have the possibility to refer to one of the actors in the fishery chain that can be held responsible for the guarantee of the quality of the fish (product). In their opinion this would be the retailer, because they feel the retailer has got something to lose from their custom. Any positive associations that could affect overall product perception would depend on the confidence the consumers have in the quality assurance. Broadly, trust is determined by the extent to which an institution or information source is perceived to be both honest and credible (i.e. expert or competent). Frewer and Salter (2002) have observed that public distrust in regulatory institutions (and indeed systems of production) may be attributable to various changes in society, which means that public reliance on the decisions of expert or elite groups are no longer tenable. There is some evidence that consumer perceptions of animal welfare and environmental impact associated with animal production systems may influence consumers regarding product choices (Steenkamp, 1997; Verbeke et al, 1999). Some consumers may be resistant to the adoption of new production practices, particularly if this involves new technological innovations that are perceived as immoral, unnatural or unethical (see, for example, Bredahl, 1999; Lassen, Madsen, Sandøe, 2002). Consumers trade off perceptions that technological innovations in production are necessary or beneficial against perceptions that a particular application is also unethical, risky or unnatural (Frewer, Howard, and Shepherd, 1997). As normally such quality assurance would require extra investments. And of course a producer would like to know whether this effort justifies an increase in the market price. For consumers, a higher price could reinforce the impression that actually quality assurance is in place. In the study carried out in group C it was hypothesized that the confidence in the controlling agent, in combination with a higher price could yield an overall positive effect on product perception. However, no such interaction emerges from the results.

Comparably to the freshness information, it is not clear whether the lack of effect stems from incapability or unwillingness of the consumers to use this information. Subjects may have been unwilling to use the information because they didn't trust it or because they didn't consider it relevant as they might expect that the experimental products will be of good quality anyway. Another reason to neglect the quality control information in the product evaluation could be that controlled quality just is considered a basic requirement for food products. In that case, indifference among consumers towards any information about the quality control might cause neglect of the information on the control agent all-together. Incapability to use the information may show itself in a lack of associations that can be inferred from the fact that the products were controlled either by the retailer or by an independent agent. The expectations pattern for group C shows that a higher price gives rise to better overall expectations for quality, attractive, pleasant, freshness, and healthy. Results in Figure 5 (expectations group C) suggests that among the higher priced products, quality control by the retailer raised more favourable expectations for the cod than quality control by an independent agent, which may be explained by the idea mentioned that retailers got more to lose if their quality assurance does not add any extra value to the product.

What does become clear, however, is that the different price levels for the products do affect expectations as well as post-consumption evaluation, mainly for the holistic attributes. Products that were higher priced rate higher on quality, attractive, pleasant, freshness, and healthy. Neither in the pre-consumption expectations, nor in the post-consumption judgments does price level affect the analytical sensory attribute ratings much. The effect of price level therefore seems to connect to a more holistic product perception, which involves more belief and intuitive judgments.

## 10.6 Information about price and advantages of fish farming

The way price levels were indicated in the current study affected product perception not largely, but significantly and consistently. Likewise in group D, both expectations and post-consumption evaluations were affected by price differences, especially for the holistic qualitative attributes. These effects are remarkable because the prices just deviated 9% from an estimated market average. Apparently, the current presentation of prices and price differences have been quite easy to process for consumers and it enabled them to infer quality differences between the experimental products. This result confirms former studies that found price to be a strong quality cue (Dawar, N. & Parker, P. 1994) In contrast, according to the attitudes questionnaire, most consumers report intermediate importance for price for buying as well as at eating.

It was anticipated that the production type "farmed" would probably not affect product perception very positively. However, a RIVO study (Kole 2001) has shown that it is well possible to make consumers reconsider their attitude when provided with the appropriate information. In this mentioned study we succeeded to make subjects adopt both more negative and more positive attitudes towards farmed fish. Therefore, in group D it was tested whether positive information on fish farming could lead to a positive shift in product ratings. The current results don't prove such an effect. All experimental products in group D being labelled "farmed", the products with extra information on the advantages of farming are rated lowest, on the holistic attributes, as well as on the analytical attributes dry, juicy, firm. This result resembles that in group A, varying production type labels. Apparently, although labelled "farmed", adding extra information about fish farming advantages affected product perception in the same way when contrasted to labels that lack this information, as did the "farmed" label when contrasted to the "wild" label. It seems that the extra information just emphasizes the fact that the fish is farmed and not captured. Under these circumstances consumers prove not to be ready to change their attitudes towards farming and to let this shift affect product perception positively.

The attitude ratings show that at buying 'production type' is judged on the average to be among the least important factors, at eating it is the least important factor. Nevertheless the current way of influencing the negative attitude towards fish farming and its effect on product perception didn't effectuate. One reason might be that the subjects were feeling manipulated by the information and subsequently were unwilling to respond positively to the information. Another explanation might be that when it comes to actually eating the products, these negative attitudes are not so easily overcome. These attitudes might be a lot more implicit than an explicit instrument can measure.

## 10.7 Role of expectations in product perception

Generally, over groups, the effects as they appear for post-consumption ratings resemble very much to the pre-consumption expectation effects. This might be indicative for the role expectations can play in product perception.

Indications of what the product information's could possibly do to product perception are derived from the expectational patterns they raise. One of the aims of the current study was to show that the different information types evoke different expectation patterns with the consumers. The finding that some of the different information types yield different expectation patterns shows that this information is accepted by the consumers and used to infer some of the characteristics of the products they are about to eat.

To specify the role these expectations can play to explain the interaction between non-tasting product information and consumer product perception, the expectations were regressed on the post-consumption evaluations.

From the regression models, it clearly shows that for all information groups, for certain attributes the expectations play a significant role in forming the post-consumption evaluation of that attribute for the different product-information combinations. This is especially the case for the non-straightforward sensory attributes. Attributes like 'healthy', 'fatty' and 'quality', are probably fuzzier and depend more on the personal beliefs of the subjects than the more simple sensory attributes (e.g. tender and juicy). Therefore it is not surprisingly that especially these attribute ratings get affected by the evoked expectations.

## 10.8 Attitudes towards product information aspects

In order to discern different groups of consumers that might respond differently to the different information types, depending on their attitudes and beliefs towards fish and fish farming, attitudes towards several aspects about fish production have been rated. Results show that consumers do discern between attributes they associate to fish farming and attributes they associate to wild captured fish. This might give clues to the way negative attitudes towards farmed fish can be approached. Positive aspects about farmed fish are that it is regarded to be free of contaminants, well controlled, safe, that it has a long shelf life, and that it is cheap. Considering the interaction of price level with product perception in this study, this idea of farmed fish being cheap could contribute to the negative image.

In contrary to some of the results that were found with the actual trial with cod, production type, day of catch, and price rank among the lower important characteristics for buying and eating fish. It shows that these explicit measures have limited value as predictors for market performance of fish products.

## 10.9 Methodology

Some methodological remarks can be made with respect to the current results. One of the goals of the study was that all testing should be performed under consumption circumstances that are as realistically as possible, in order to obtain good external validity of the results. According to some post experimental interviews, the subjects were not too much disturbed by the fact that the experimental products came with some instructions to prepare. This possible threat to external validity seems not to have influenced the results a lot. It appeared that most participants did the testing seriously. This may have led to more than normal attention to the package and the labels that were attached to it. This might have compensated for the labels not being very fancy and attractive to read. On the other hand, not all the information exerted effects on the product evaluations. It therefore seems safe to assume that the occurrence of effects of label information on product judgments is related to the content of the information and not to specific attention or an experimental effect.

Considering validity, however, the results cannot be directly extrapolated to the entire (Dutch) population, as the consumers involved were not fully representative for the entire Dutch population. On the average, higher educated people from the West and Middle of the country, with an income above the average are over represented. Another remark with respect to the sampling is that the number of consumers proved to be too large. Variance generally was more restricted than expected in such uncontrolled testing environment. The TasteNet consumer panel proved far more robust than was expected for this study. This might be the reason for finding statistical significance even for some very small effects. However, this threat to validity could be solved in discussing the relative effects within groups and in being critical about accepting effects for real. The figures help a lot to do so.

Furthermore, it can be seen that the absolute levels of the ratings do not differ very much between for example group A (production type labels) and group D (labelled "farmed" and with positive farming information). This result points to a framing effect, where ratings of products labelled "farmed" in group D just set the judging standard in group D that coincides with the judging standard in group A. This has no serious consequences for the interpretation of the results as they are discussed relatively, within groups.

## 11. Conclusions

- ?? The product information as it was presented in this study clearly affected product perception in some cases, although the labels were not very fancy.
- ?? Differences between farmed cod and wild cod were limited in this study, and sensory-analytical of nature (dry, juicy, firm, flabby).
- ?? It was shown that pre consumption expectations contribute substantially to the formation of post consumption evaluations of integral products, i.e. products that combine physical and credential information. This means that during product development (for example farmed fish) equal attention must be paid to both information sources.
- ?? The information presented along with the cod was able to evoke distinct expectational patterns for consumers, especially for production type and price level.
- ?? The information presented consistently affected product perception and evaluation, especially the information on production type and price level. The effects were minor for information on the quality controlling agent, and freshness data. The effects were unexpectedly negative for positive information on fish farming.
- ?? The production type label effects, point toward a poor image for farmed fish. There is little difference between no- or "wild" label, but the label "farmed" induces more negative evaluations.
- ?? Higher prices yield more positive expectations and product ratings.
- ?? Indications for these effects being image related are that the effects are strongest for the holistic quality judgments. In general few specific analytical sensory attributes get affected.
- ?? This in-home consumer study shows that the sensory-analytical attributes are no good predictors for overall product evaluation.
- ?? Actual behaviour in product evaluation does not match with self reported explicit beliefs and attitudes concerning what is important when eating fish. Hardly any effect was found for freshness information, which consumers indicate to be very important when buying and eating fish. Large effects are observed for production type labelling, whereas consumers rate this aspect lowest important when eating fish. Price appears to be an influential perceptual cue, whereas it is only rated to be moderately important, both when buying and when eating fish.

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## 12. Practical recommendations

- ?? It was shown that pre consumption expectations raised by the experimental products and their information labels, contribute substantially to the formation of post consumption evaluations of the products. This implies that during product development equal attention should be paid to both the physical and credential information that potential customers perceive and that helps them forming their future product evaluations. In the current case of developing markets for farmed cod, it is clear that a lot of attention should be paid to the perception that are attached to the way the cod is produced.
- ?? Apparently, farming of fish has a poor image among consumers. Consequently, two strategies could be relevant in the market.
- ?? One could be to dissociate from the “farmed” label. Farmed fish should be positioned in a different fish food category, focusing on the positive characteristics that are recognized according to the current results. In this category the contrast with wild captured fish should be avoided. The current results suggest that price level might be a useful cue for repositioning farmed fish. If well marketed, farmed fish might eventually be able to benefit from higher price categories, featuring its own particular added values. High prices are now associated with wild fish, as expensive, luxurious products.
- ?? Alternatively, the poor image of farmed fish could be changed. This as well would be a multiple years strategy, but the current increase in farming production and building new production systems offers opportunities to design and adapt the production systems towards positive consumer perceptions. Producers who do so should communicate it and present it as added value in the market.

## 13. Recommendations for further research

### 13.1 Additional analyses with the current data

- ?? It was concluded that in the current analyses the sensory analytical evaluations of the experimental products were not very predictive for the hedonic ratings. An in-depth analysis could explore the power of this conclusion. It could be explored which analytical attributes do and which do not relate to hedonic perceptions and in what direction. Such analysis would yield concrete directions for farmers to work on to improve their farmed cod according to consumers' preferences.
- ?? The relation between sensory analytic and holistic evaluations need not be strictly linear, neither has to be the relationship between expectations and post consumption product perception. The notion that food products should be developed integrally (i.e. intrinsic and extrinsic characteristics along) adds some challenging relationships to account for when predicting product perception. According to the literature, the discrepancy between expectations and the actual product is likely to affect a) the mere analytic and holistic evaluations, but also b) an additional 'expectation disconfirmation' effect. The latter effect roughly states that the bigger the discrepancy between expectation and actual product, the more negative overall product evaluation will be. It is unclear yet whether this holds for analytical attributes, holistic attributes, or both. In the current design, a 'subjective' measurement of expectation-disconfirmation was included. Analysis of these relationships might prove very relevant for integrated product development.
- ?? The attitude questionnaire was designed such as to relate particularly to opinions that could affect the influence of the different information on the labels. The size of the consumer sample that was used was chosen as to allow sub sampling according to several criteria that are related to the label information. Separate analyses of results for relevant consumer groups would provide a lot more insight in the ways that could be chosen to approach the consumer market.
- ?? The same type of analyses would apply to segmentation of consumers in the current sample according to specific preferences. Preferences might apply both to sensory as well as credential product characteristics.
- ?? Finally, the current data could be used along with other within-batch data to explore the differences in variation in ratings between wild and farmed cod. It could be advantageous to know whether, and if – how, each type of production varies in product quality. Hypothesis would be that wild cod shows a lot more variation in quality than does farmed cod, because raising conditions are much more controlled. This is not only methodologically relevant, but also for the marketing of farmed cod.



## 13.2 New research

Suggestions were made that the lack of effects that were found in the current study might be due to the presentation of the information. E.g. 'freshness' did not have an effect in the way it was tested in this research, but since it is generally viewed as an important quality indicator, other visualizations might be worthwhile trying. The same holds for the way the price information was operationalized. Consumers obviously understood and had themselves influenced by the way price-information was given in this study. However, relative pricing as was used now, is not extremely externally valid. For optimal pricing strategies it would be necessary to study the influence of absolute pricing without reference.

Additionally, other types of information as they occur in the marketplace, might be interesting to explore in this experimental way. The current method has been proven to be able to show market discriminative power. This instrument could be used to further explore the strategy as was suggested above (practical recommendations). Factors that could help to create a separate (niche) market for farmed cod could be studied. A particular niche market is often the best starting point to build confidence in a product and/or its brand.

Although the consumers in this study seemed not very sensitive to extra information on fish farming practices, it can be expected that information on these practices will be communicated by the media as farming continues to grow. Consequently we still suggest it might be wise to keep studying and exploring consumer perception of these issues in order to find out what information does have attentional value for consumers and how it affects their product valuation. First, we are convinced that politics and media practices will raise consumer interest in sustainable production, animal welfare and health. Fish farming practices will be judged against these criteria. Second, the products derived from farming practices are especially fit to meet consumer demands for easy and healthy foods. The image of the farmed products will depend on these criteria, which will subsequently influence perception and appreciation of the products by consumers. Therefore it remains important to know which are key factors in this image and how these key factors affect perception.

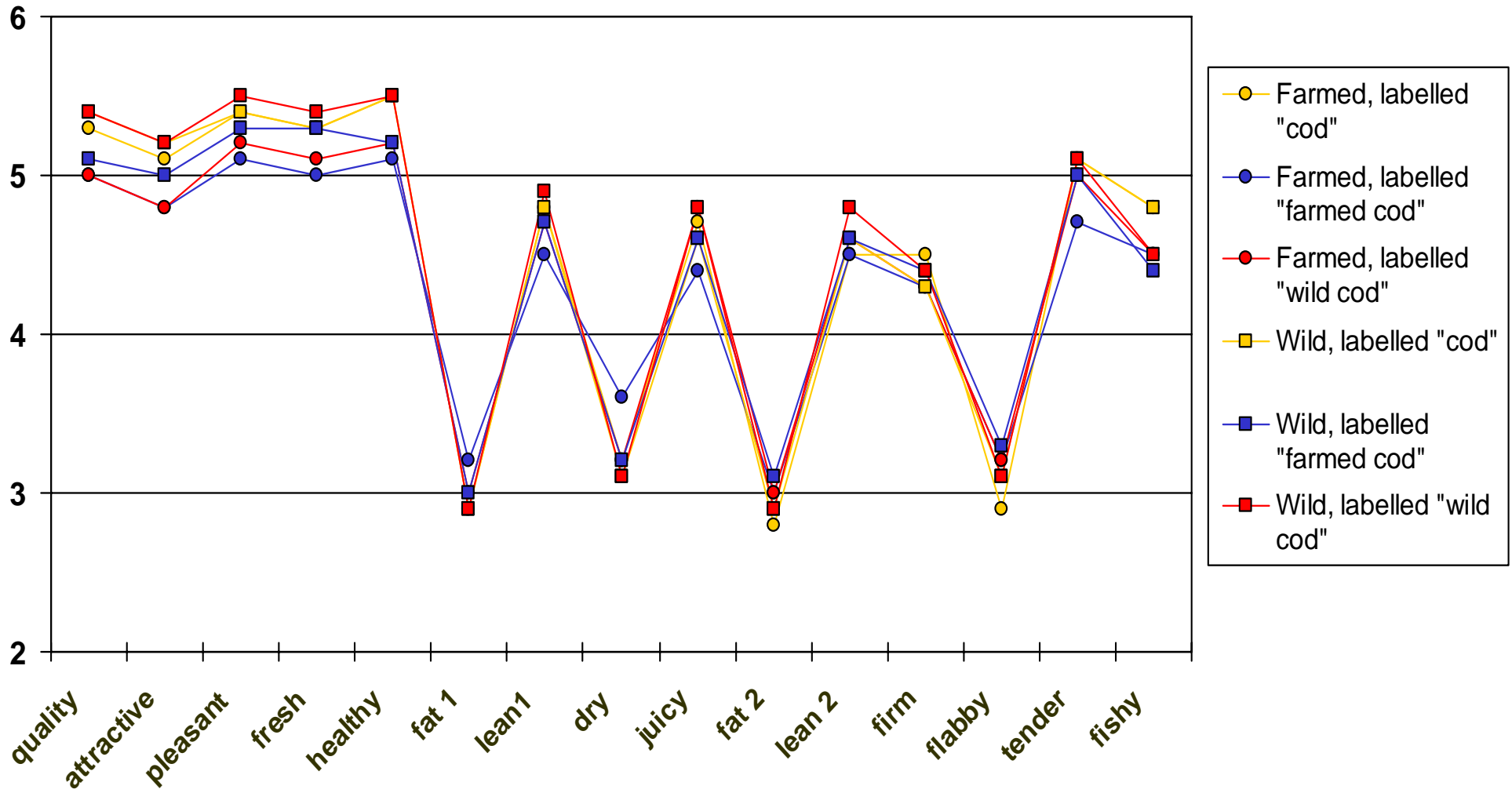
The relevance of all these types of market information might differ per country. As international expansion of the Norwegian fish farming industry increases, it will become more and more strategic information to know what exactly are the cultural differences between consumer usage and perceptions of these products in the different cultural export markets. These differences should be explored in order to be well market directed.

Finally, some information influences perception, but in the end perceptions should affect the 'willingness' to actually pay the right prices. Creative ways of studying this willingness to pay are needed to make these results even more relevant. For example, current economic science shows examples of 'experimental auctions', in order to illicit true consumer valuations of market products more validly. At the Netherlands Institute of Fisheries Research we did some encouraging studies with this method, which seems to work well in order to measure consumer valuation of production method characteristics, as farming, wild capturing, and several sustainability issues (Kole, preliminary, unpublished results).

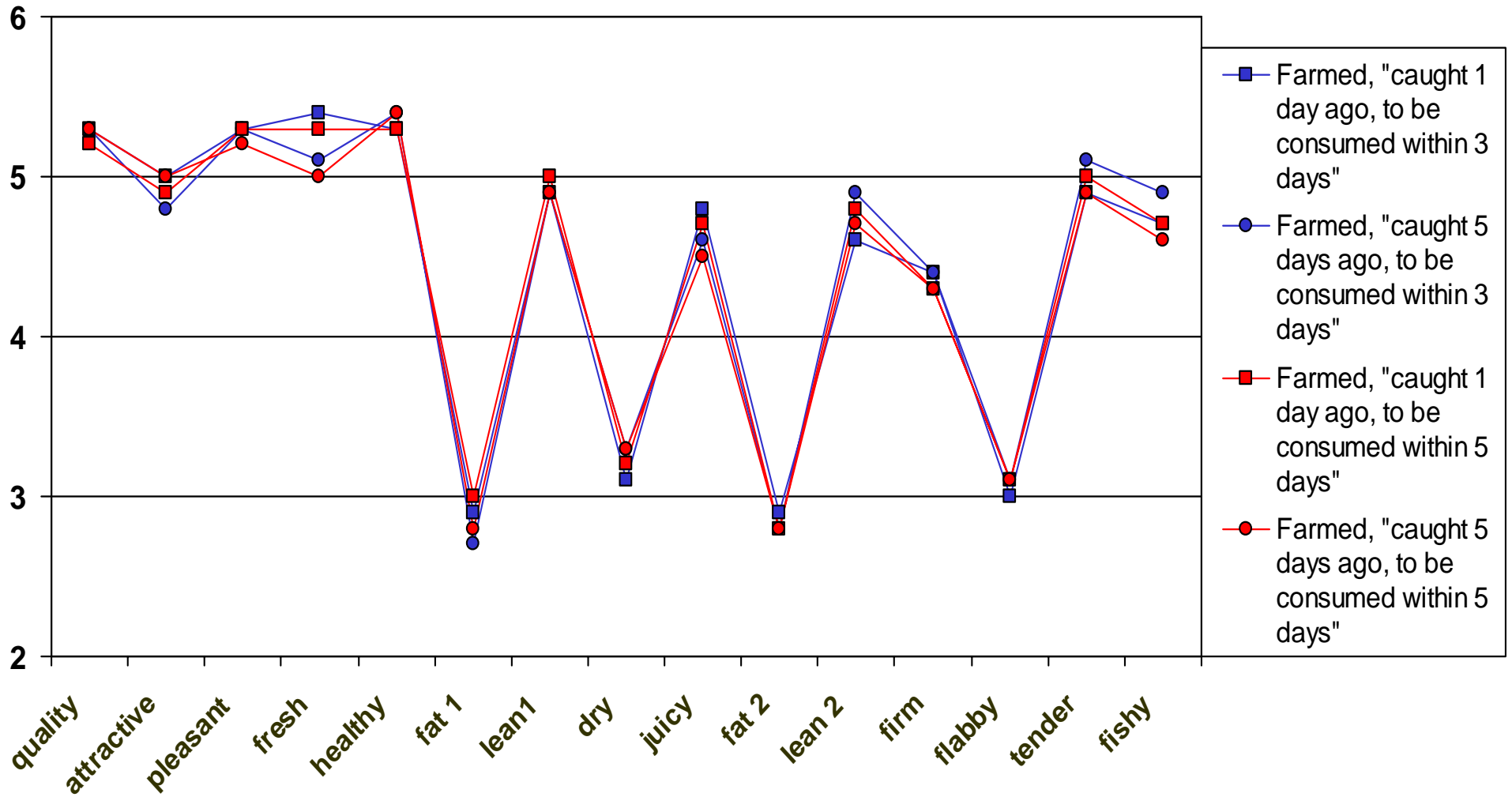
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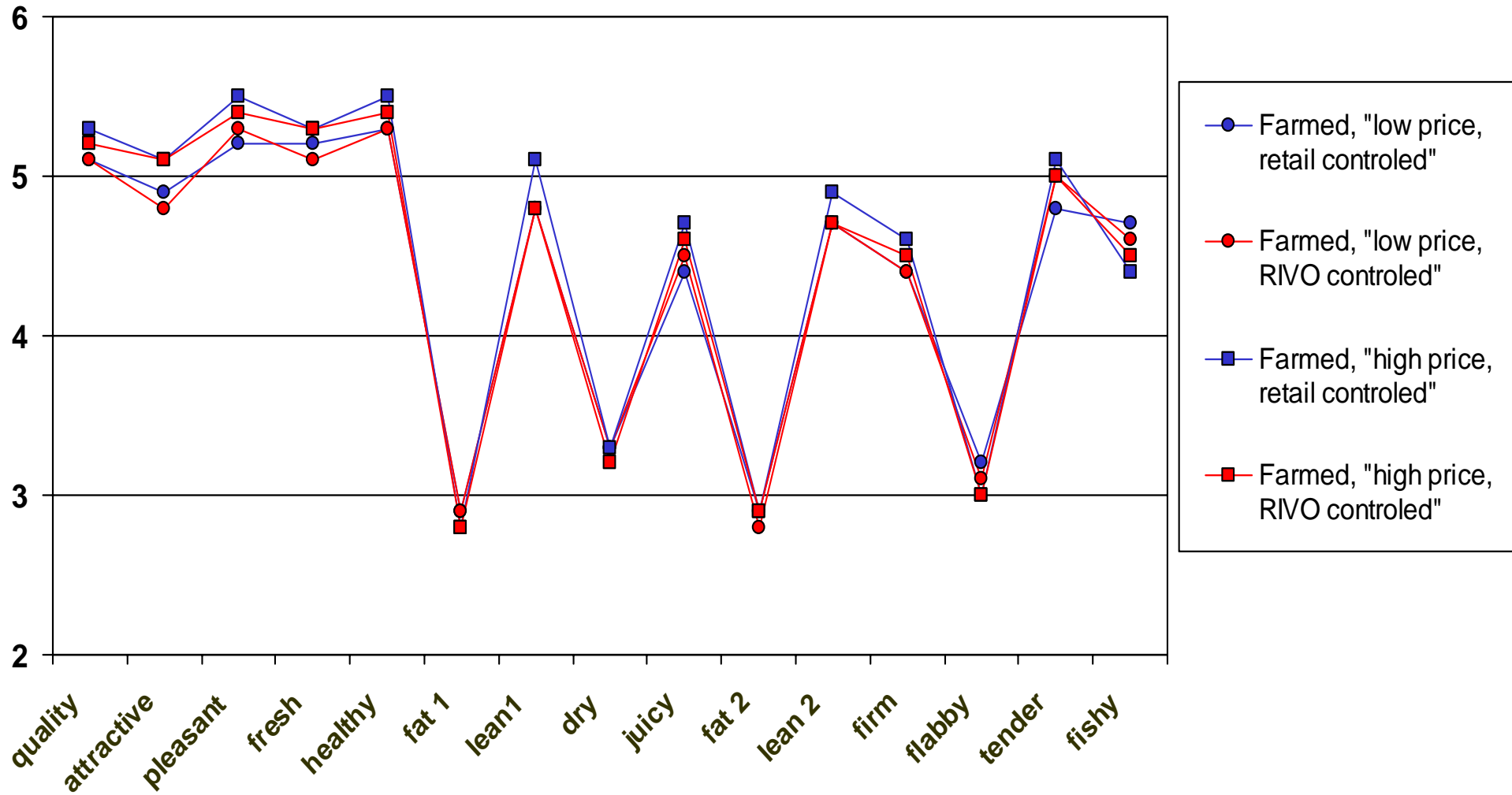
**Figure 2. Pre consumption expectations (X) Group A**



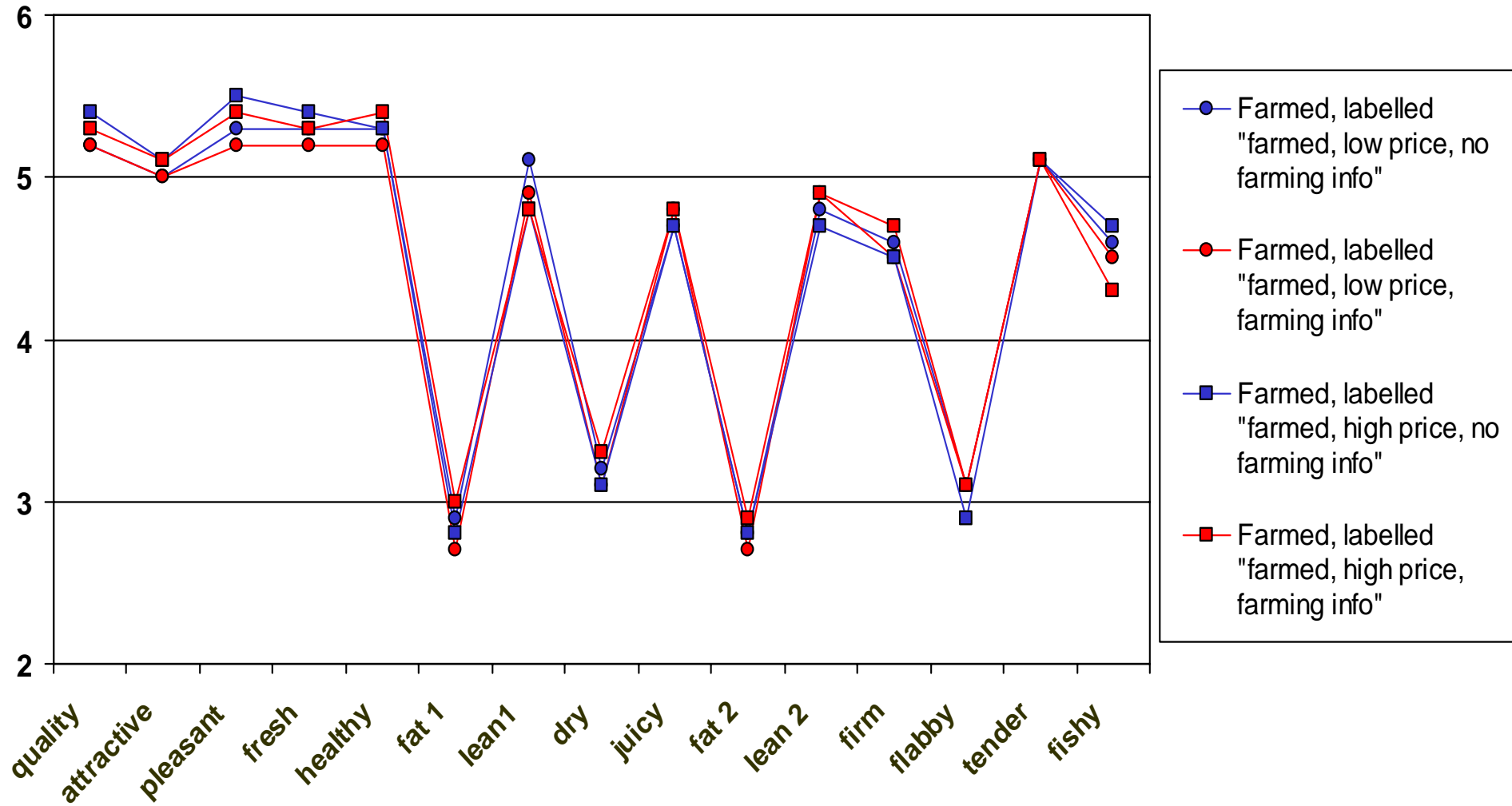
# Figure 3. Pre consumption expectations (X) group B



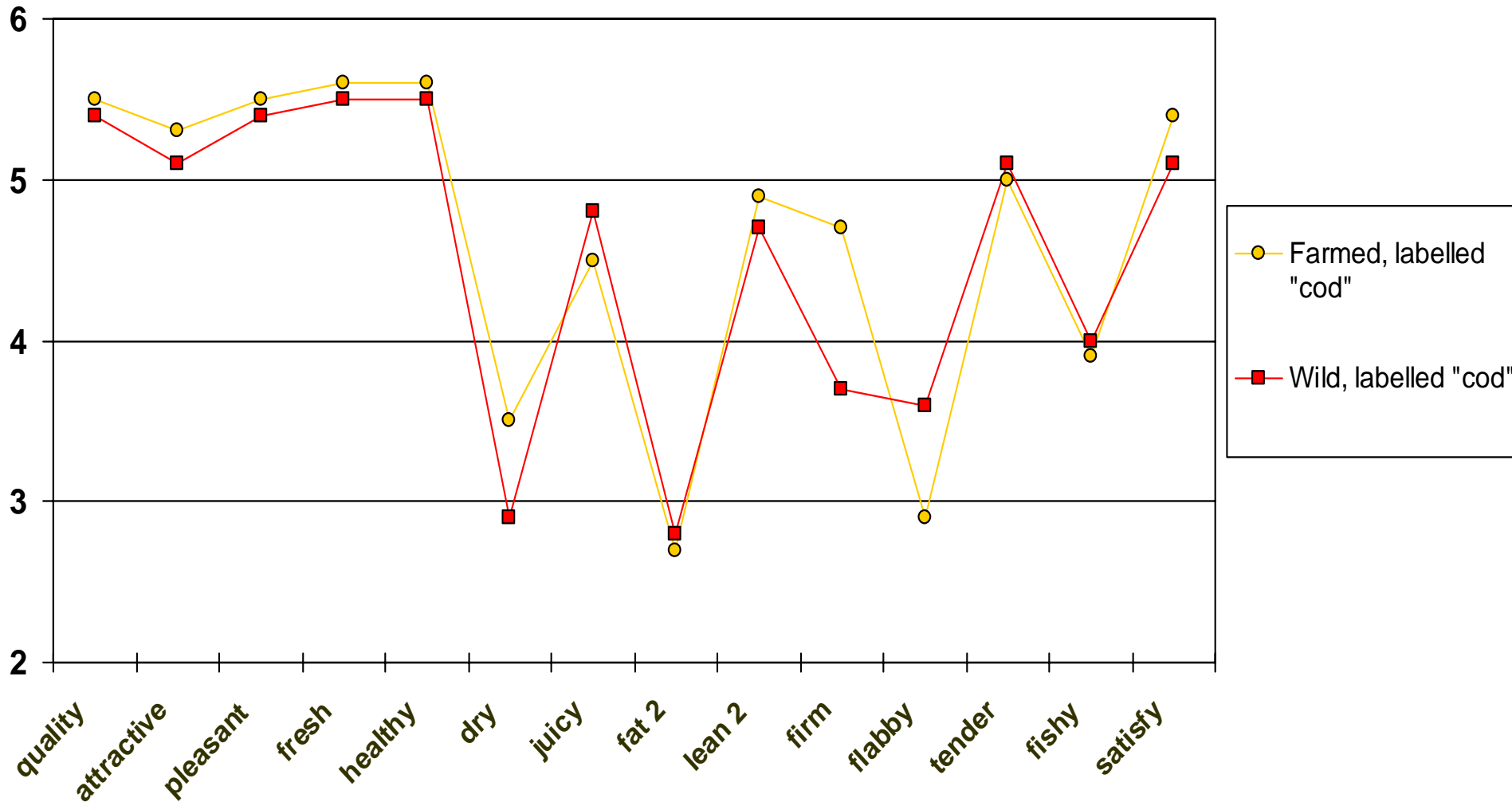
# Figure 4. Pre consumption expectations (X) group C



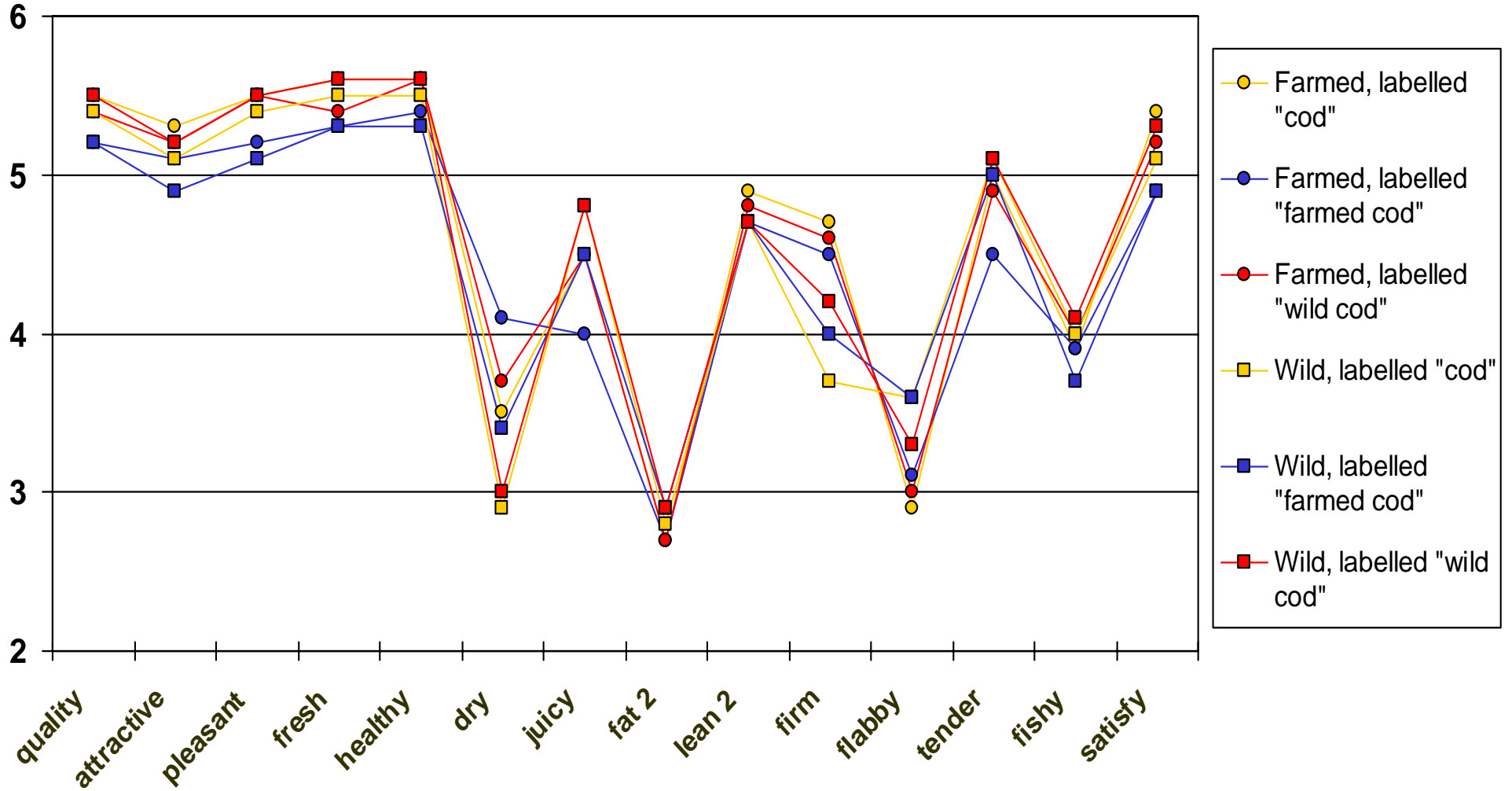
# Figure 5. Pre consumption expectations (X) group D



**Figure 6. Post consumption experiences “cod” (B) group A**

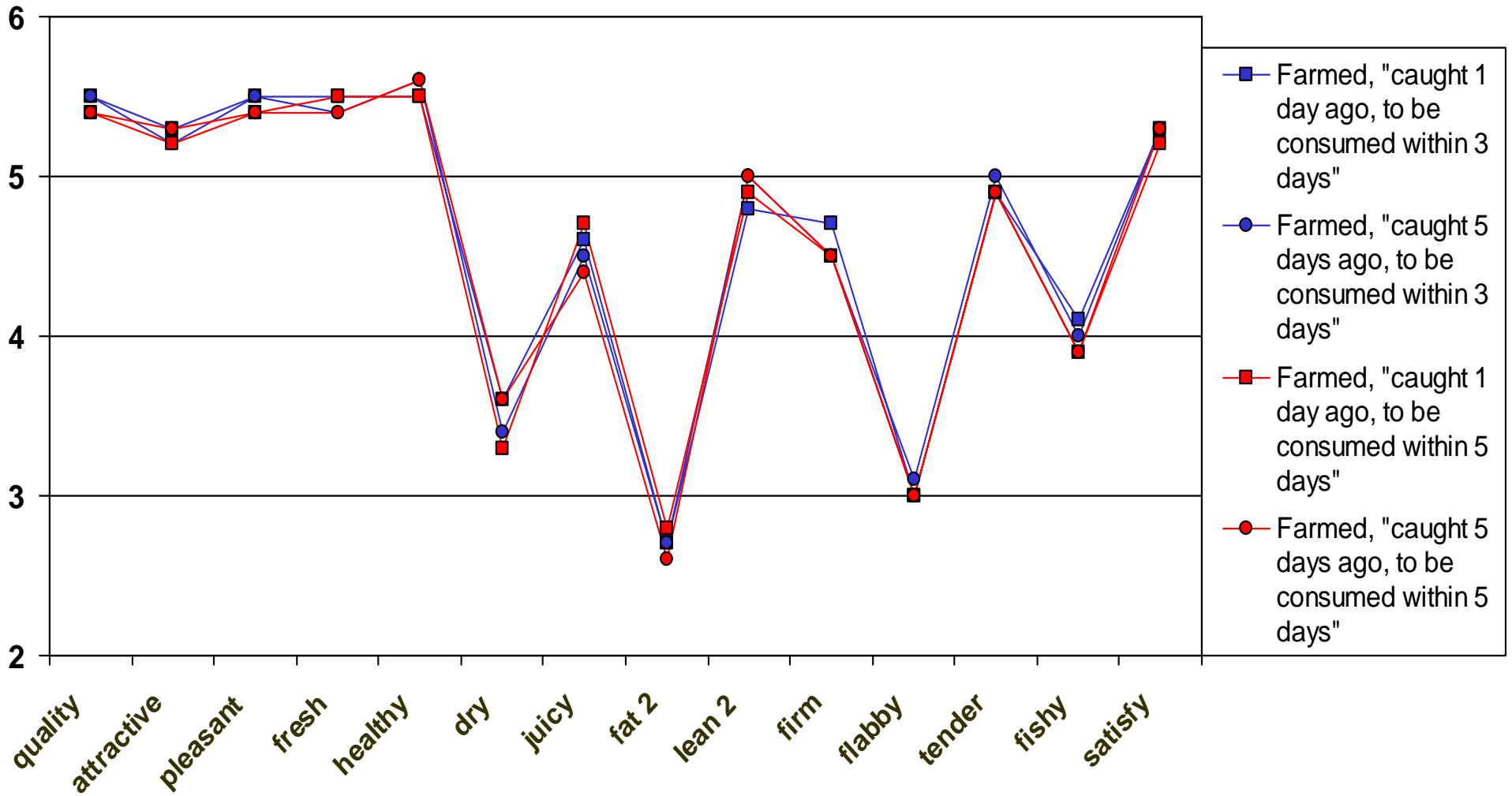


**Figure 7. Post consumption experiences (T) group A**

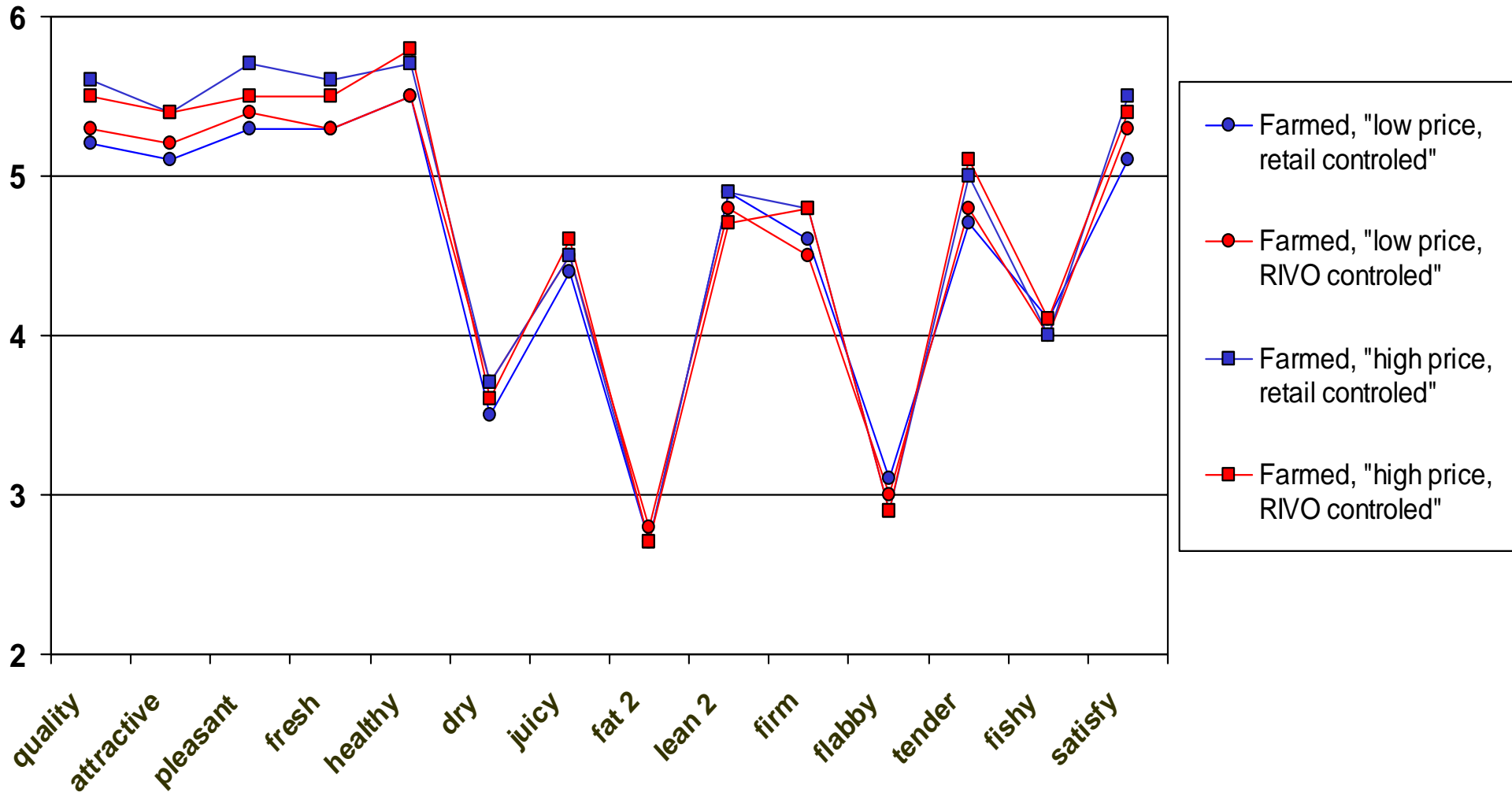




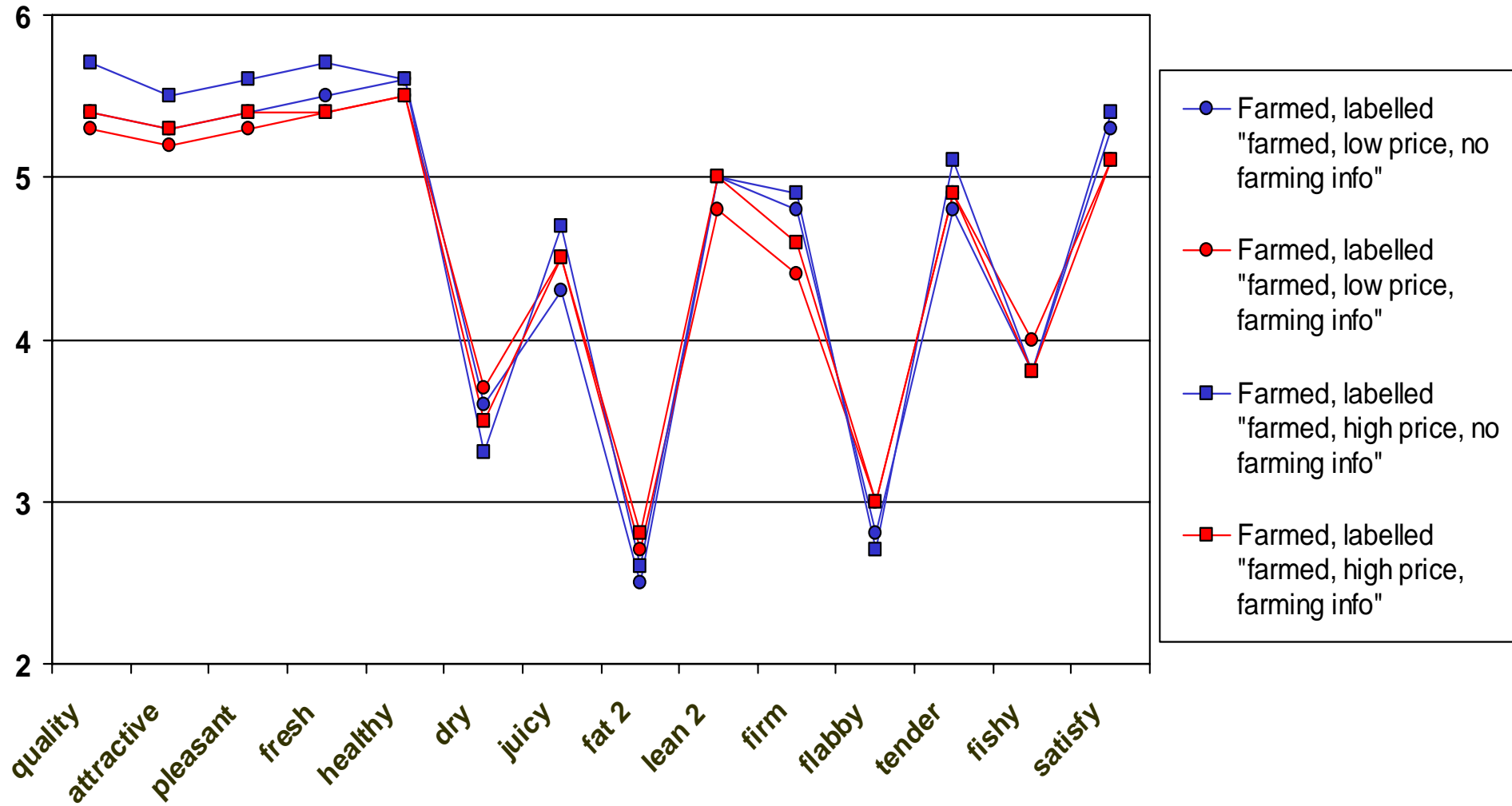
**Figure 8. Post consumption experiences (T) group B**



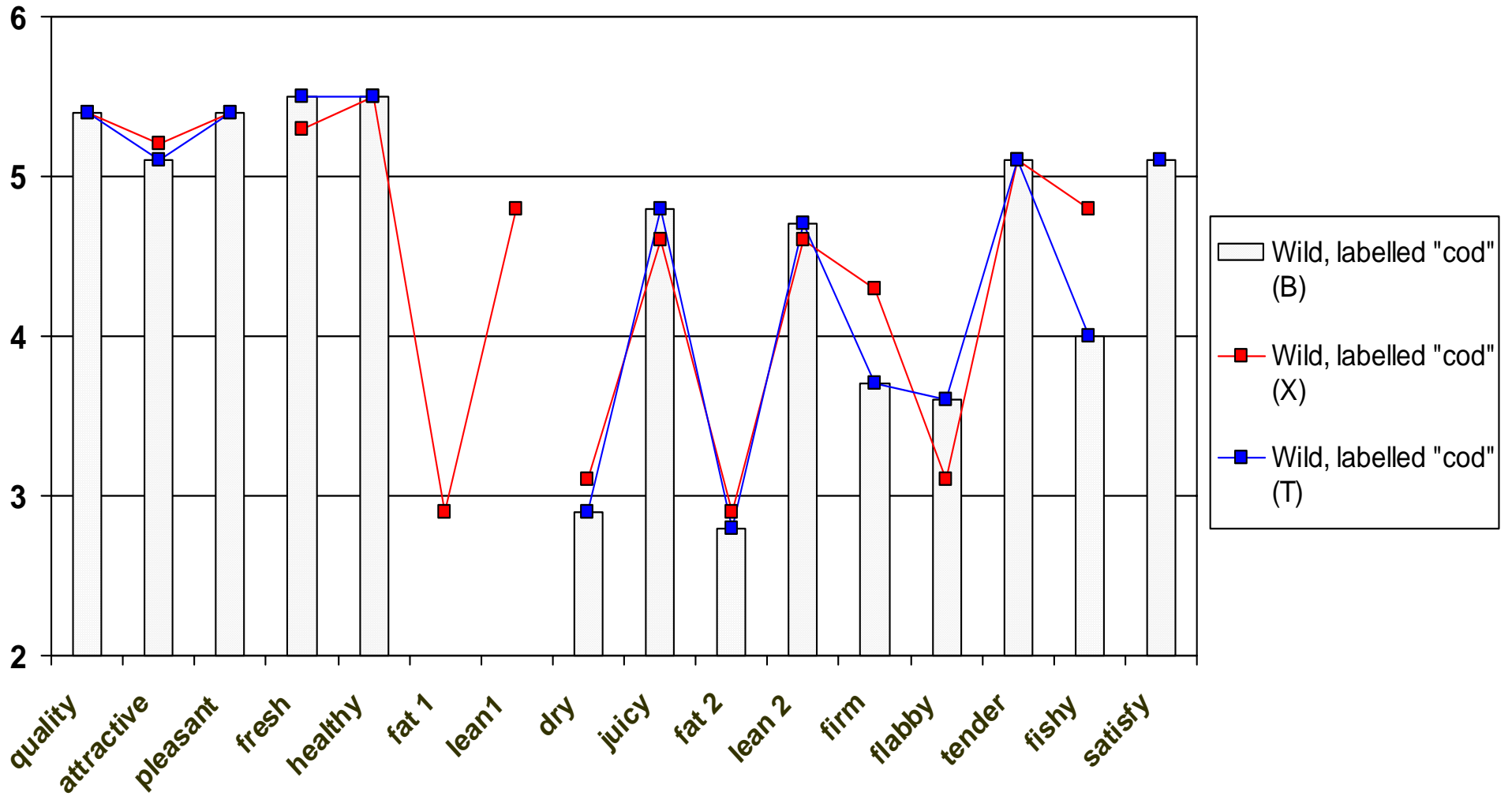
**Figure 9. Post consumption experiences (T) group C**



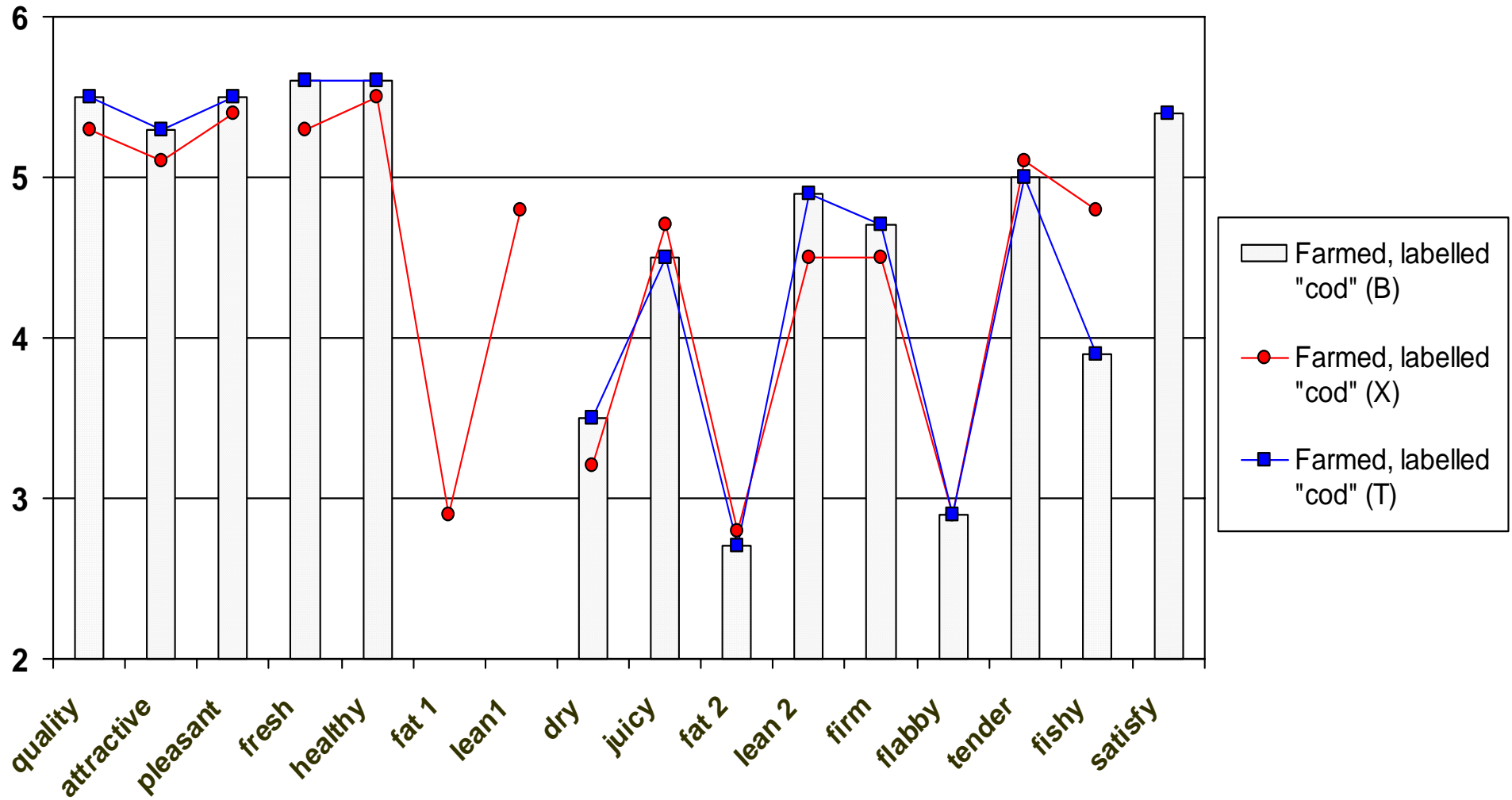
**Figure 10. Post consumption experiences (T) group D**



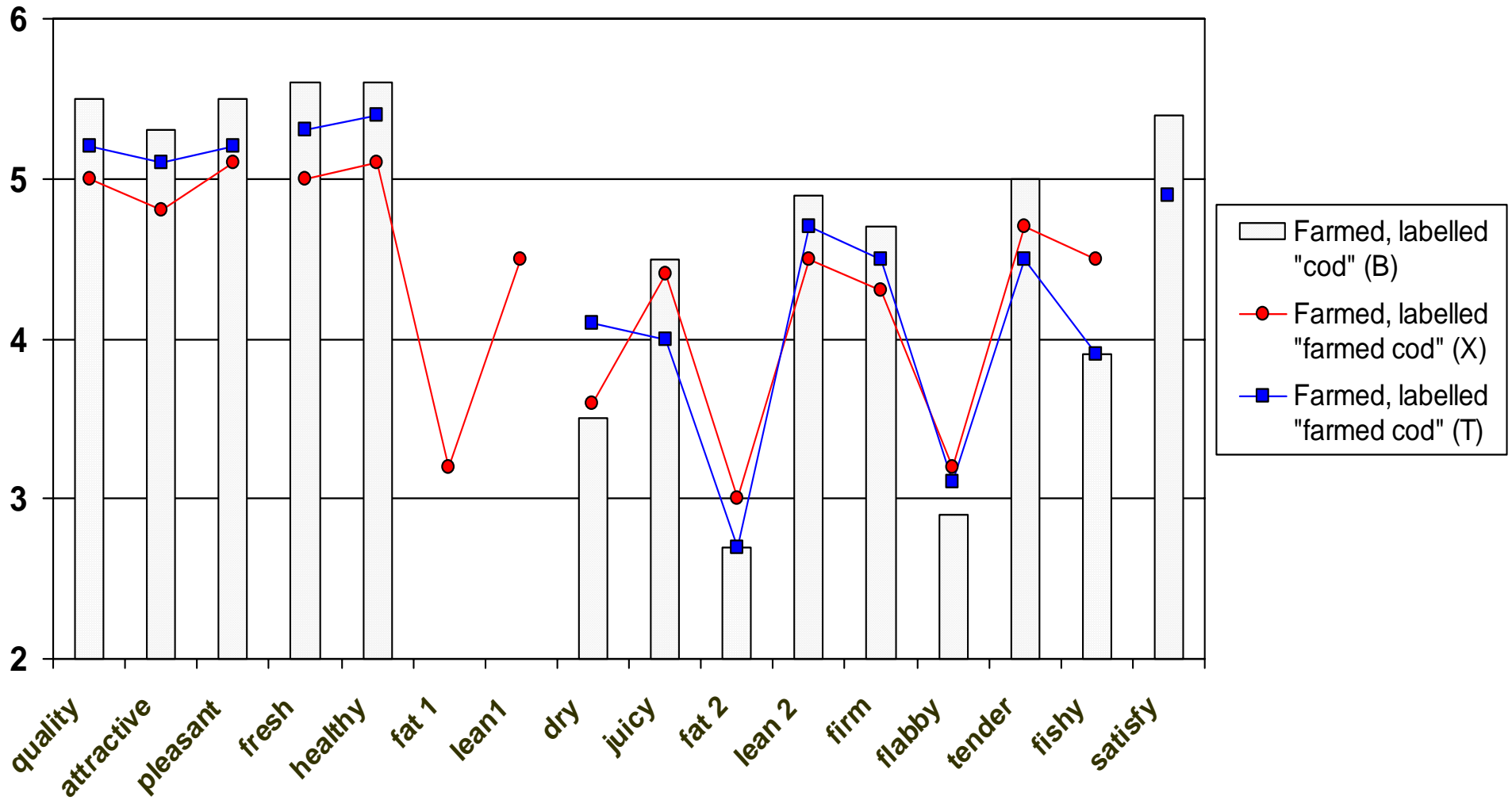
**Figure 11. Differences pre- and post consumption ratings  
Group A – Wild labelled “cod”**



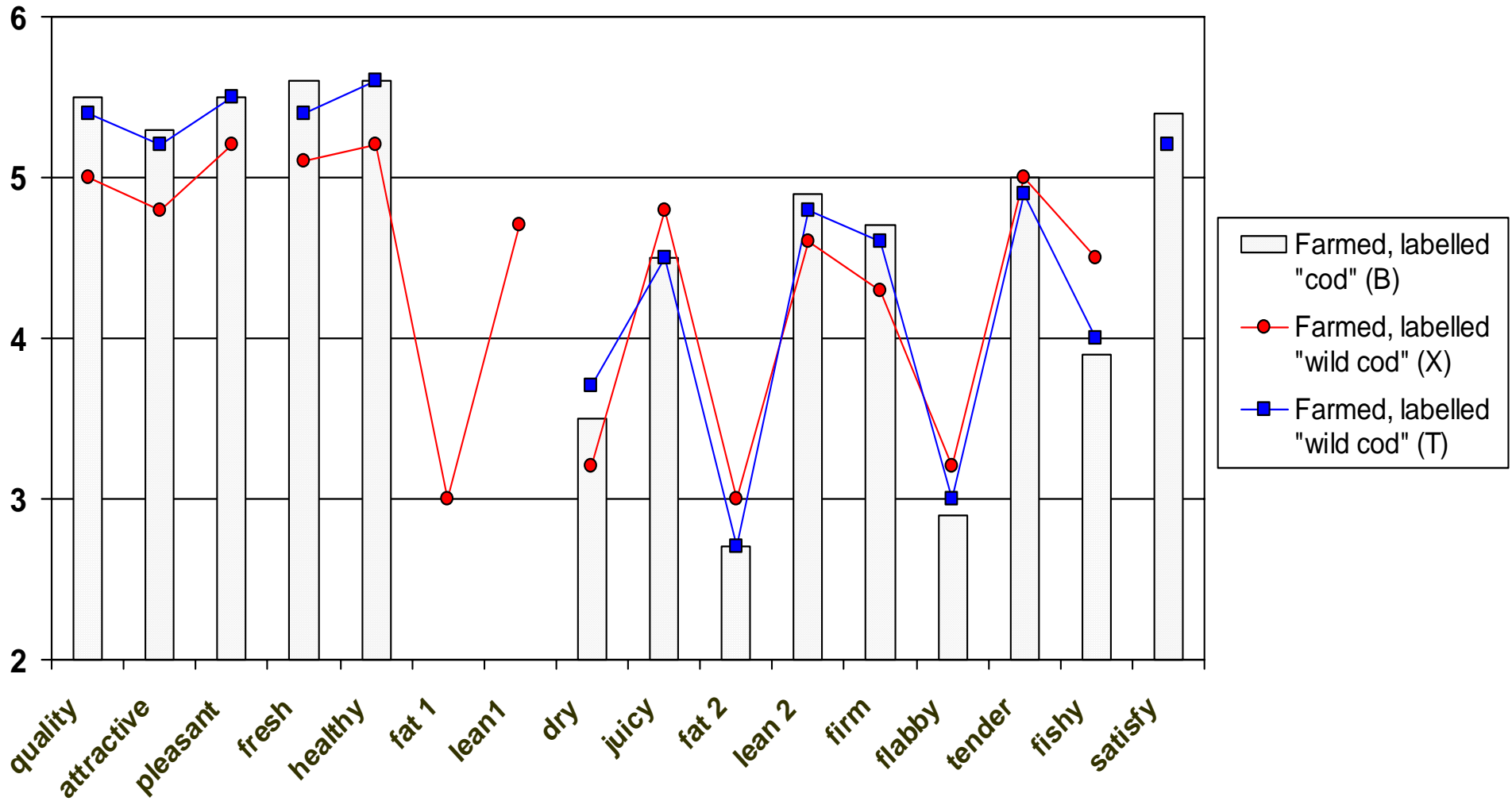
**Figure 12. Differences pre- and post consumption ratings  
Group A – Farmed labelled “cod”**



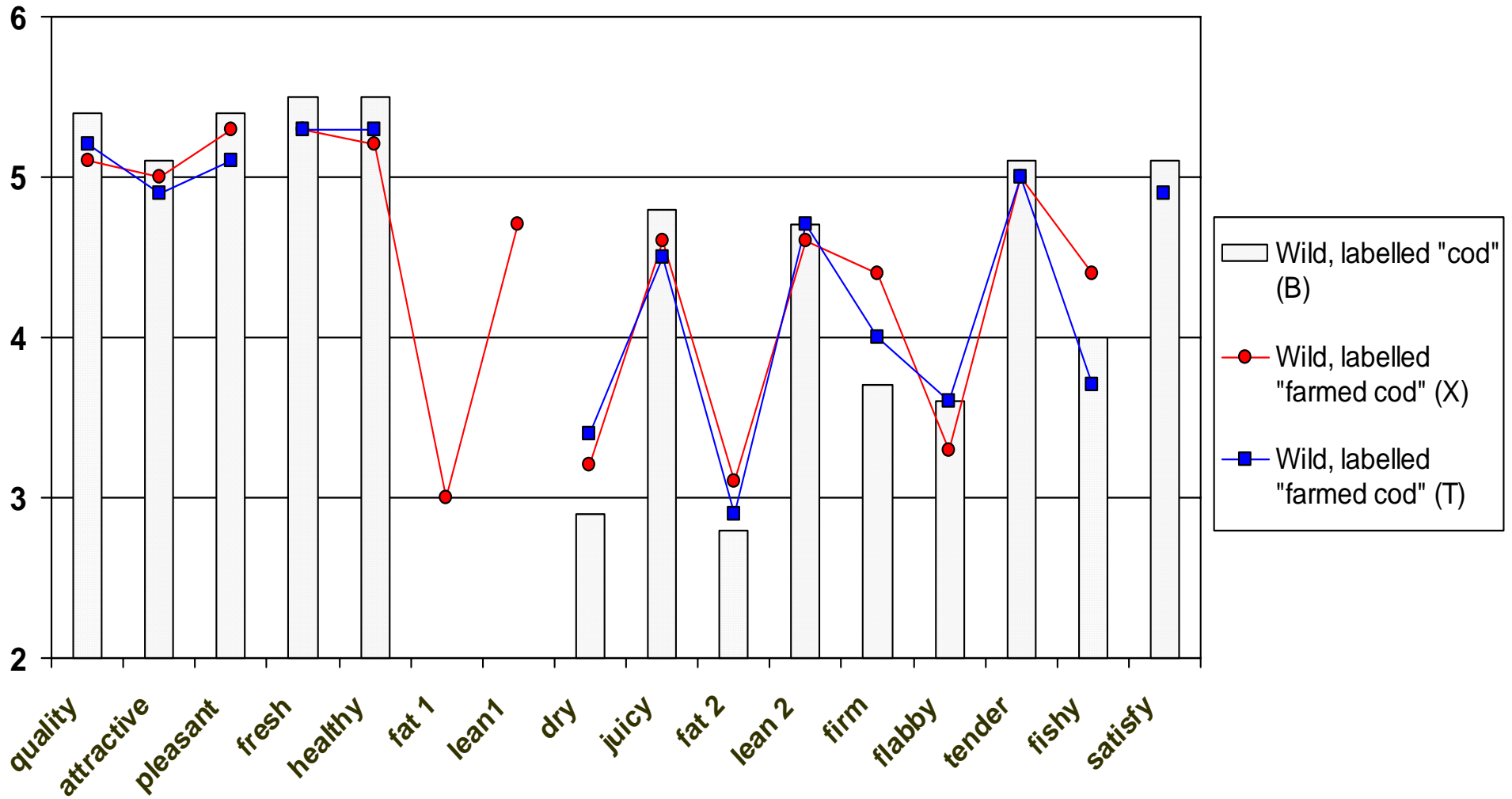
**Figure 13. Differences pre- and post consumption ratings  
Group A – Farmed labelled “farmed cod”**



**Figure 14. Differences pre- and post consumption ratings  
Group A – Farmed labelled “wild cod”**

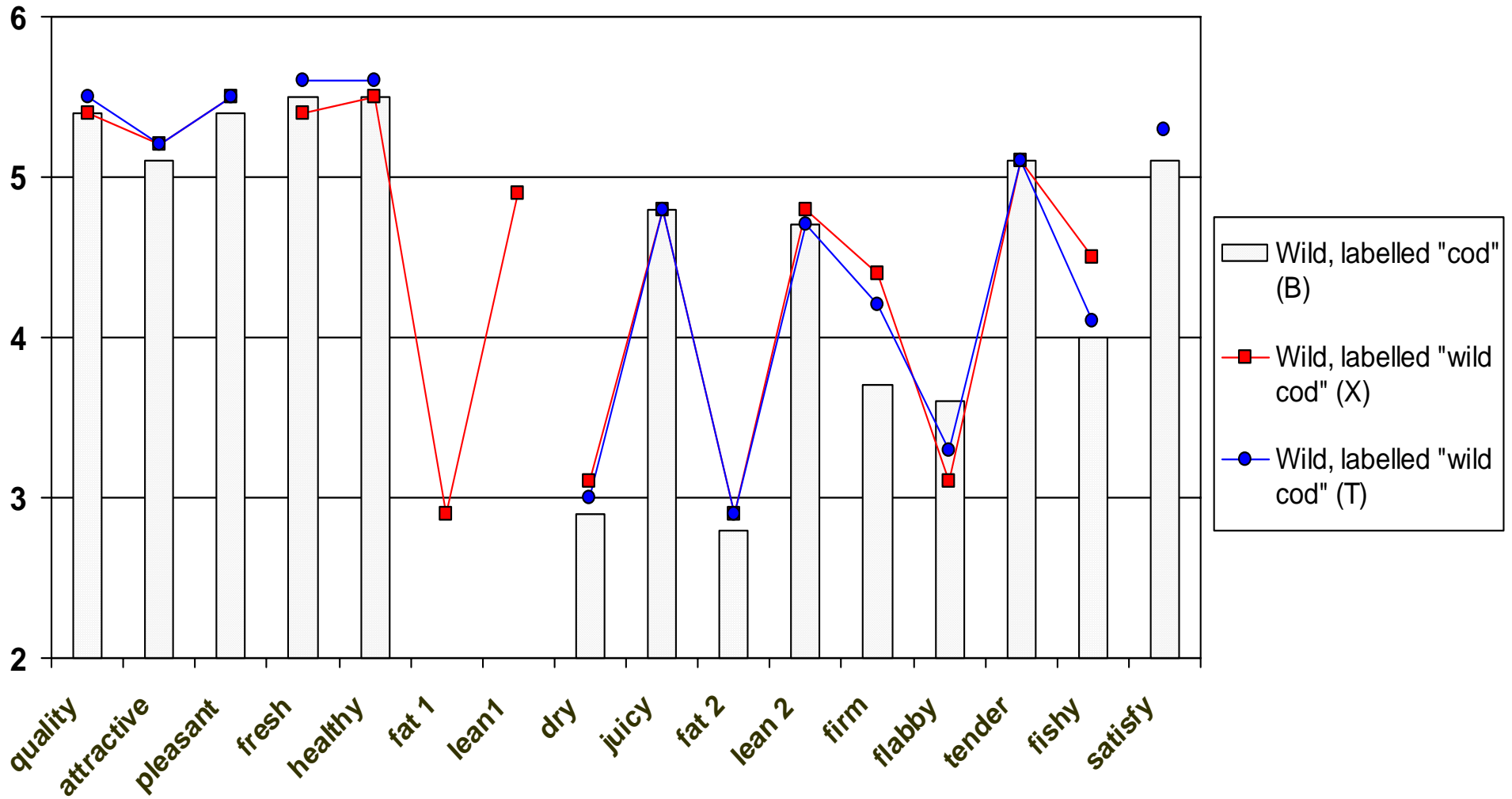


**Figure 15. Differences pre- and post consumption ratings  
Group A – Wild labelled “farmed cod”**

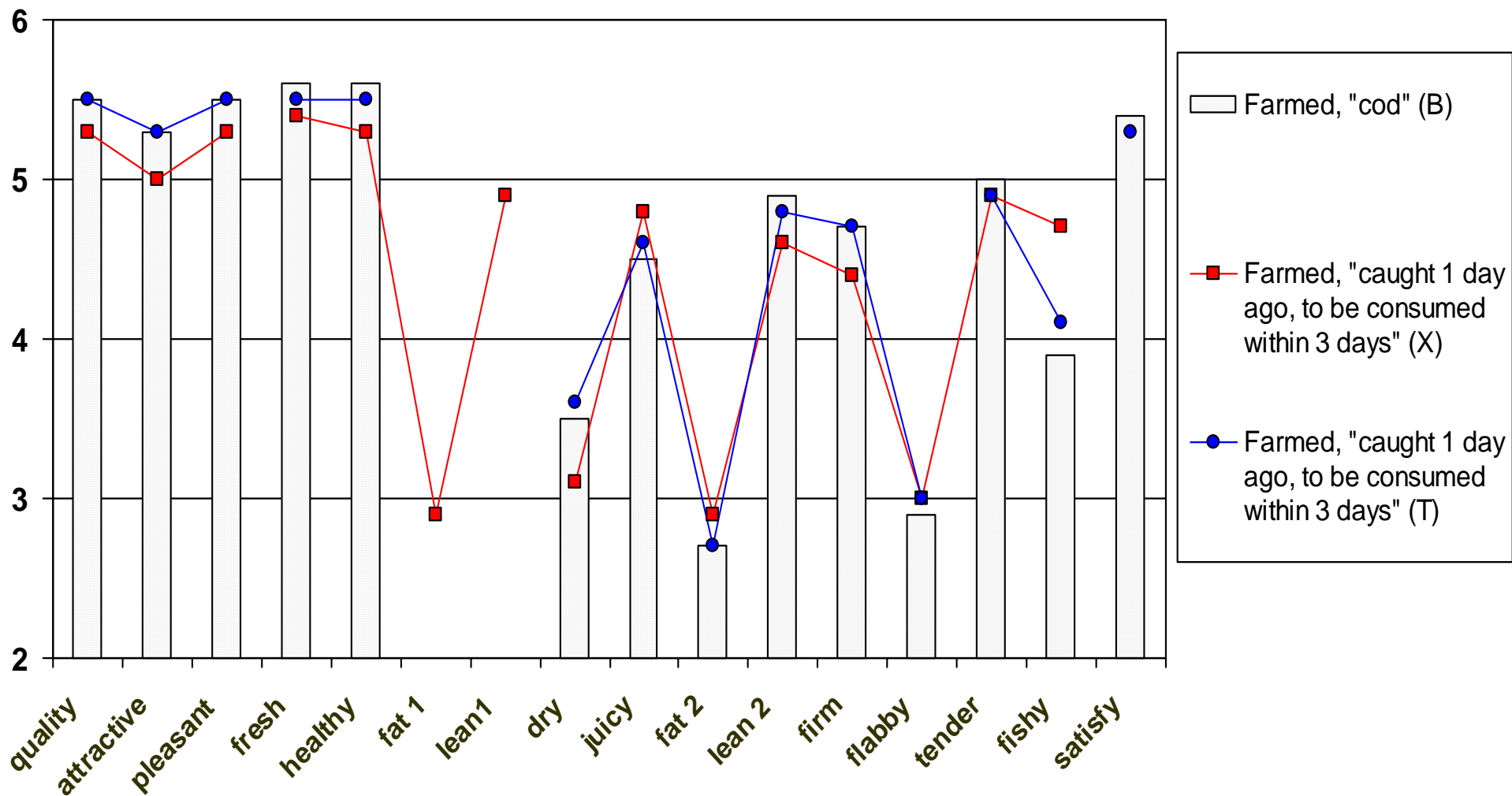




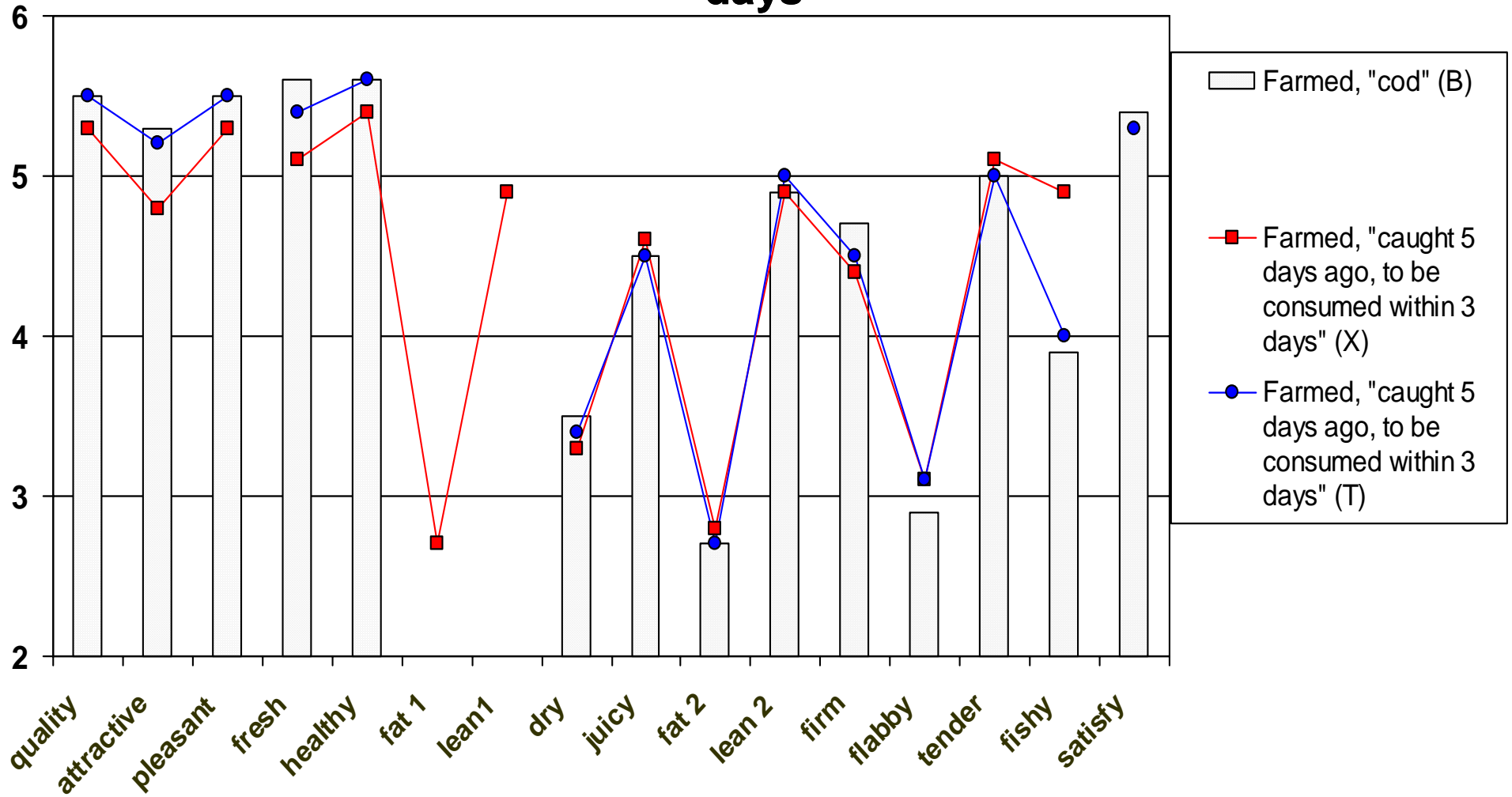
**Figure 16. Differences pre- and post consumption ratings**  
**Group A – Wild labelled “wild cod”**



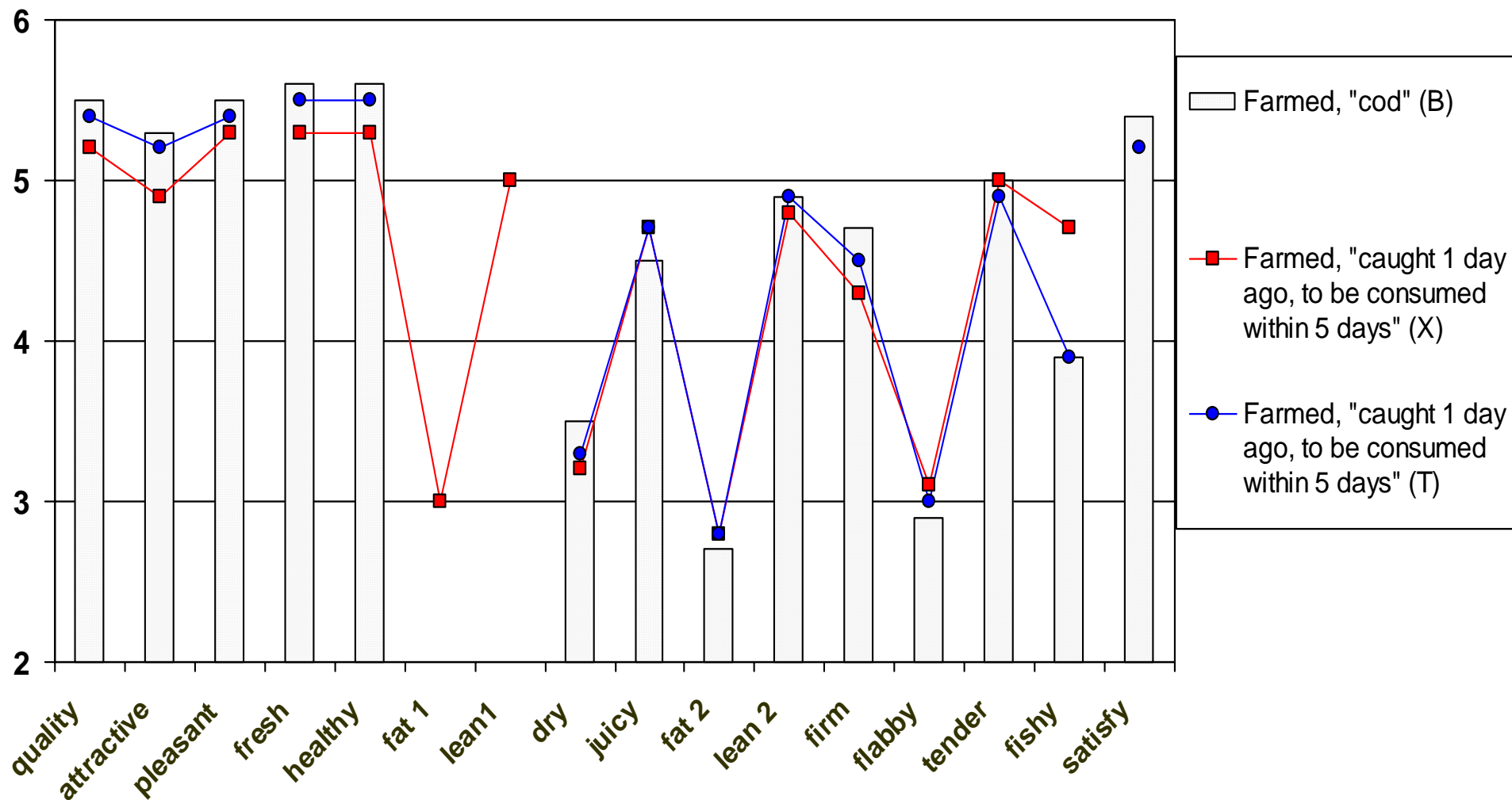
**Figure 17. Differences pre- and post consumption ratings**  
**Group B – Farmed, “caught 1 day ago, to be consumed within 3 days”**



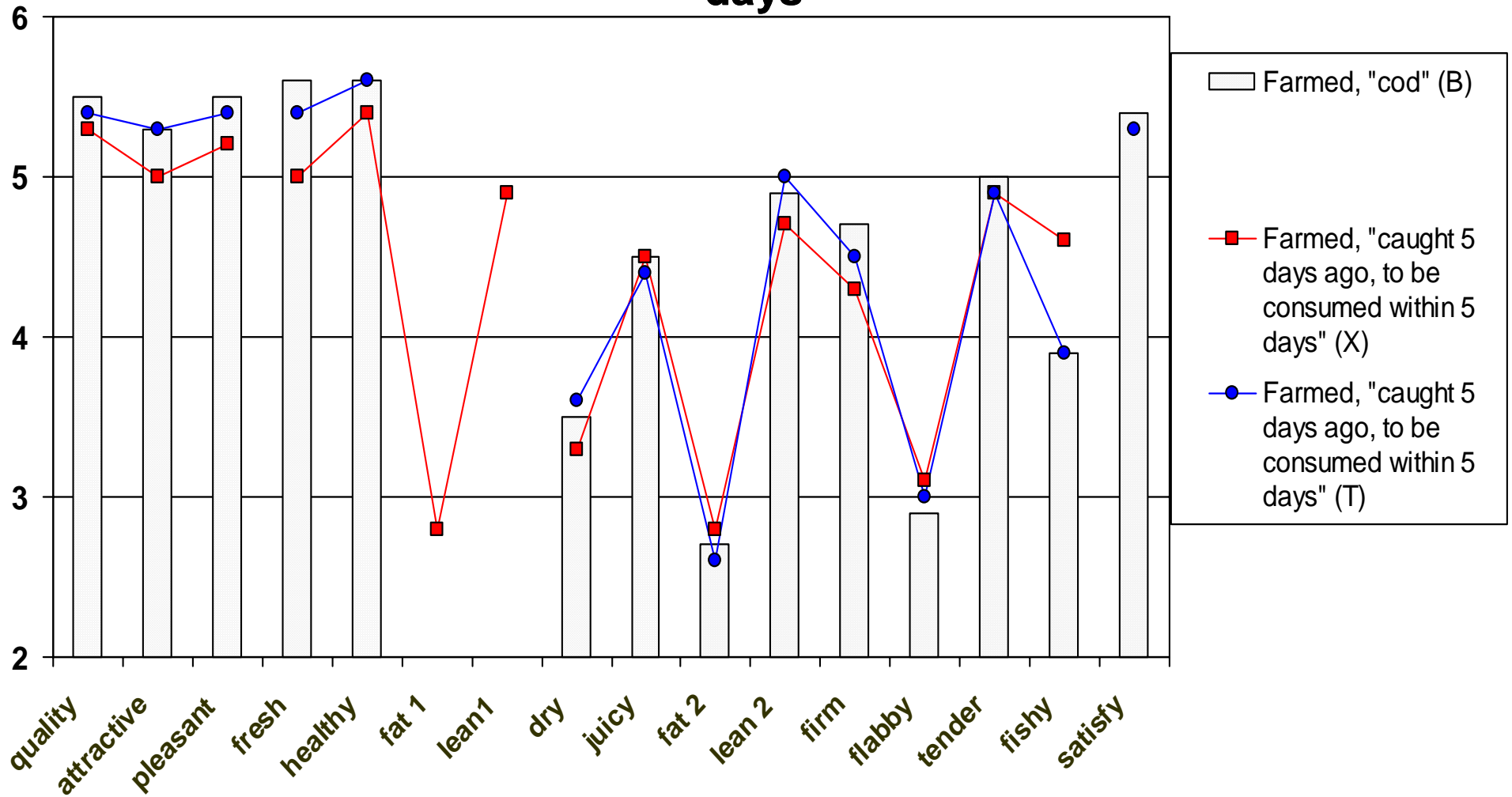
**Figure 18. Differences pre- and post consumption ratings  
Group B – Farmed, “caught 5 days ago, to be consumed within 3 days”**



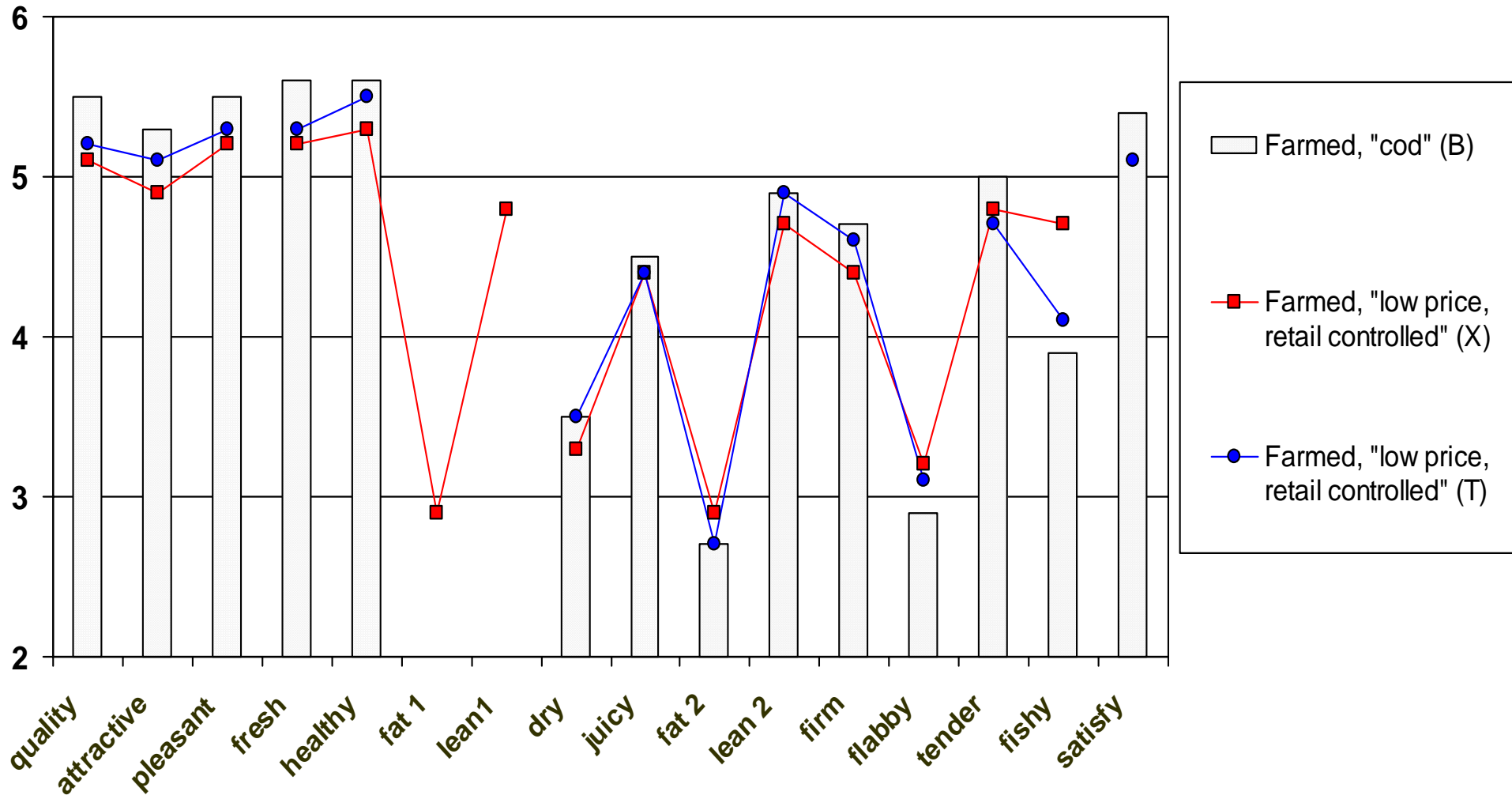
**Figure 19. Differences pre- and post consumption ratings**  
**Group B – Farmed, “caught 1 day ago, to be consumed within 5 days”**



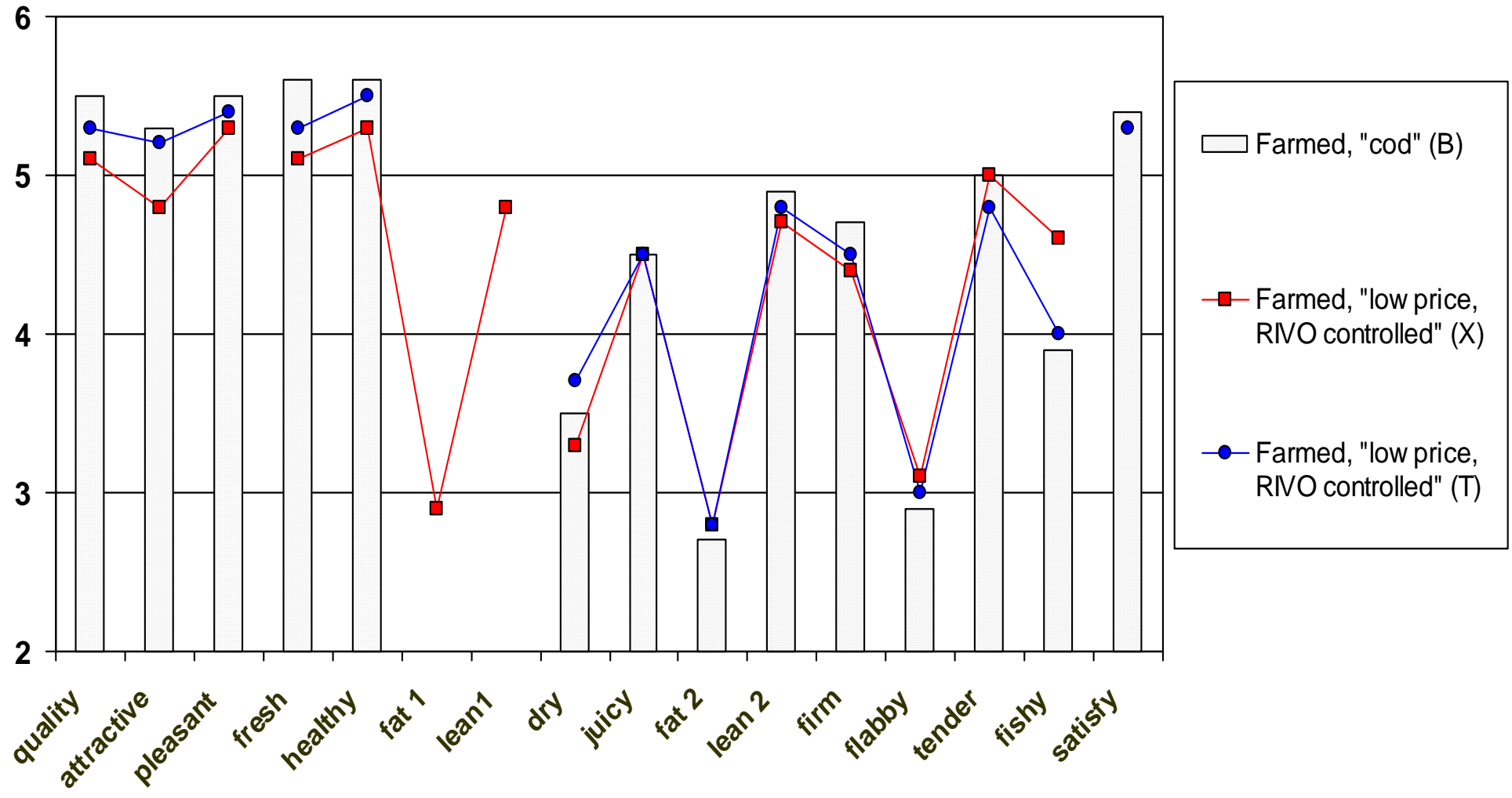
**Figure 20. Differences pre- and post consumption ratings  
Group B – Farmed, “caught 5 days ago, to be consumed within 5 days”**



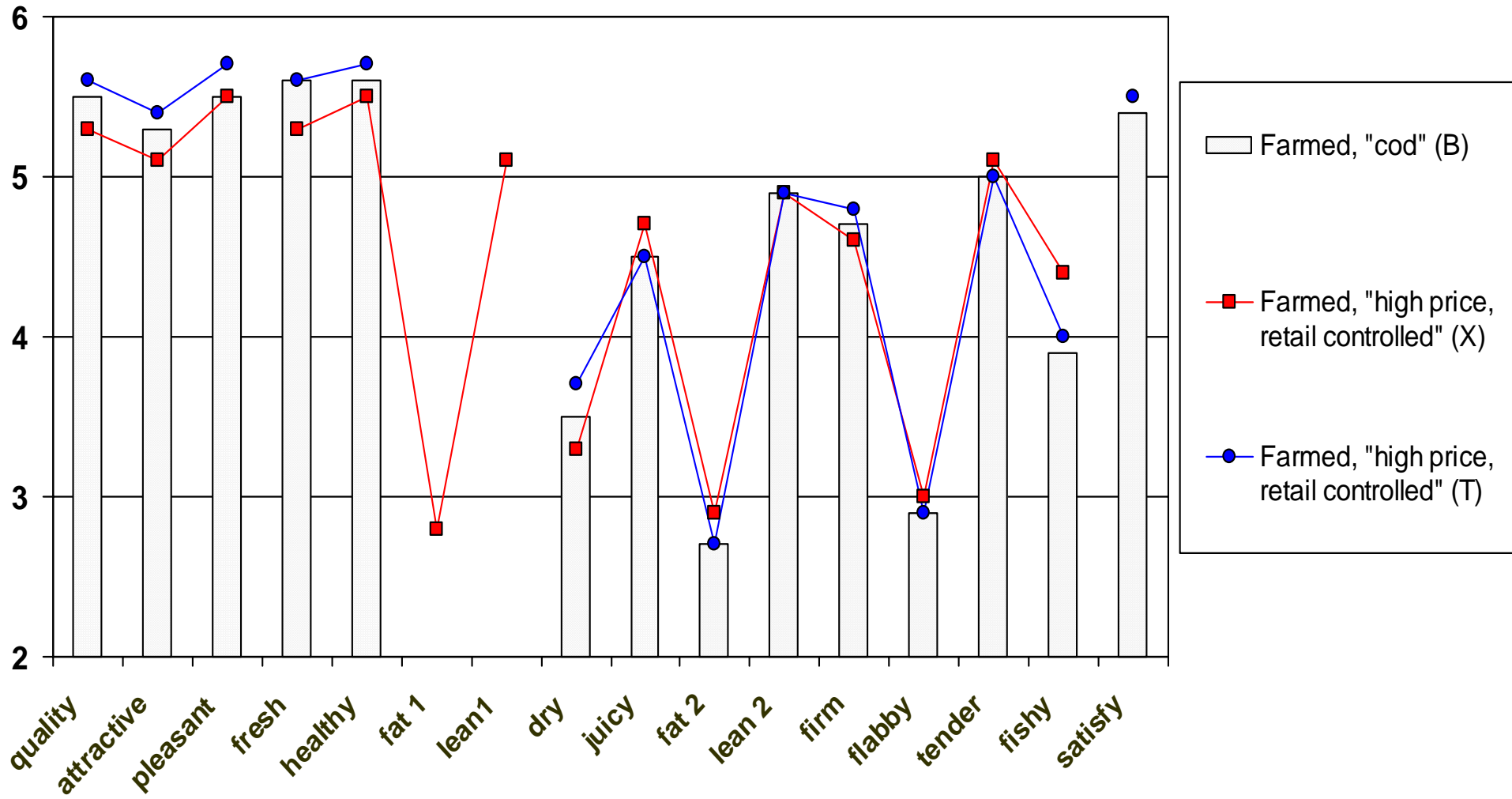
**Figure 21. Differences pre- and post consumption ratings  
Group C – Farmed, “low price, retail controlled”**



**Figure 22. Differences pre- and post consumption ratings**  
**Group C – Farmed, “low price, RIVO controlled”**

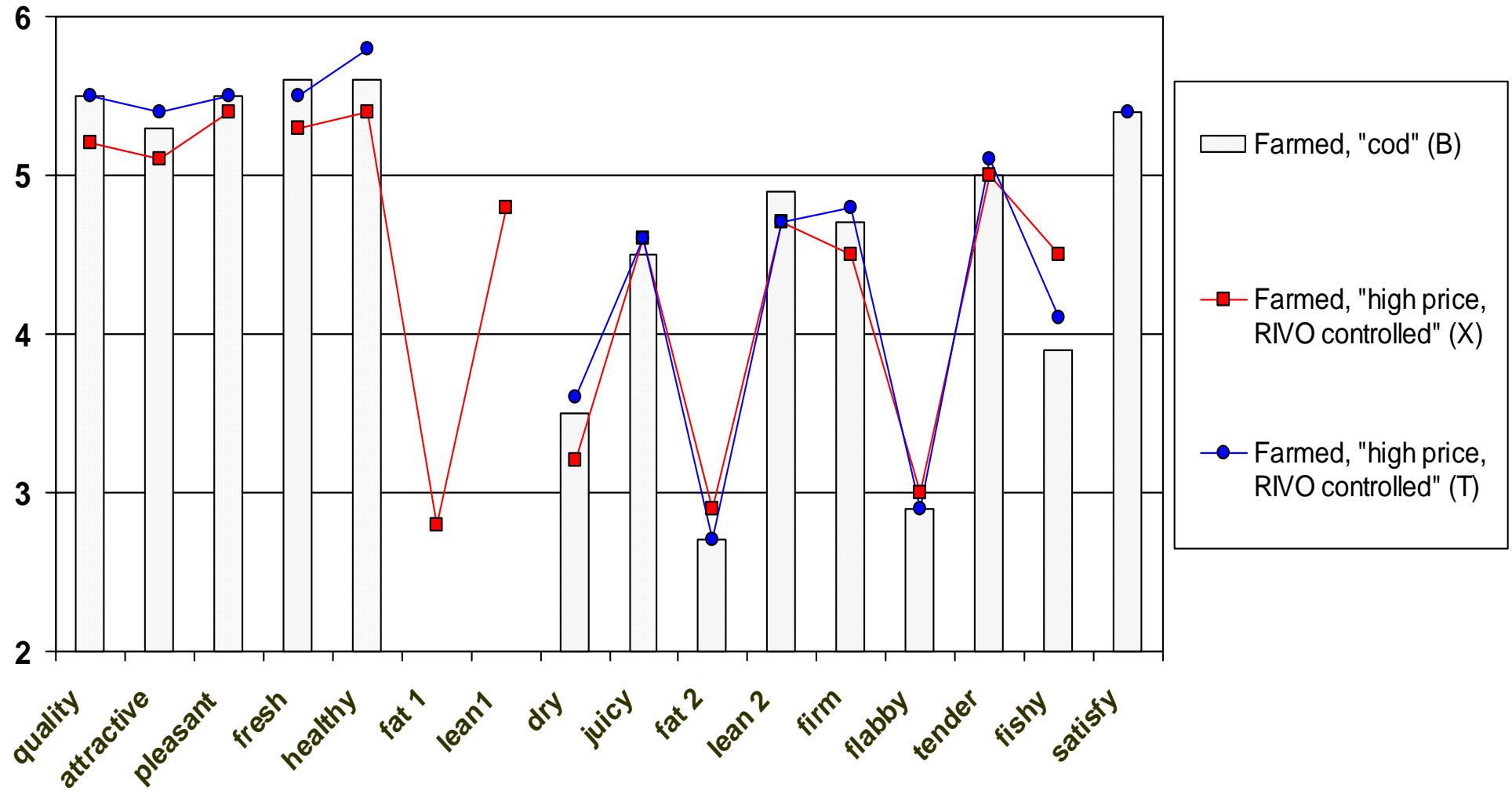


**Figure 23. Differences pre- and post consumption ratings**  
**Group C – Farmed, “high price, retail controlled”**

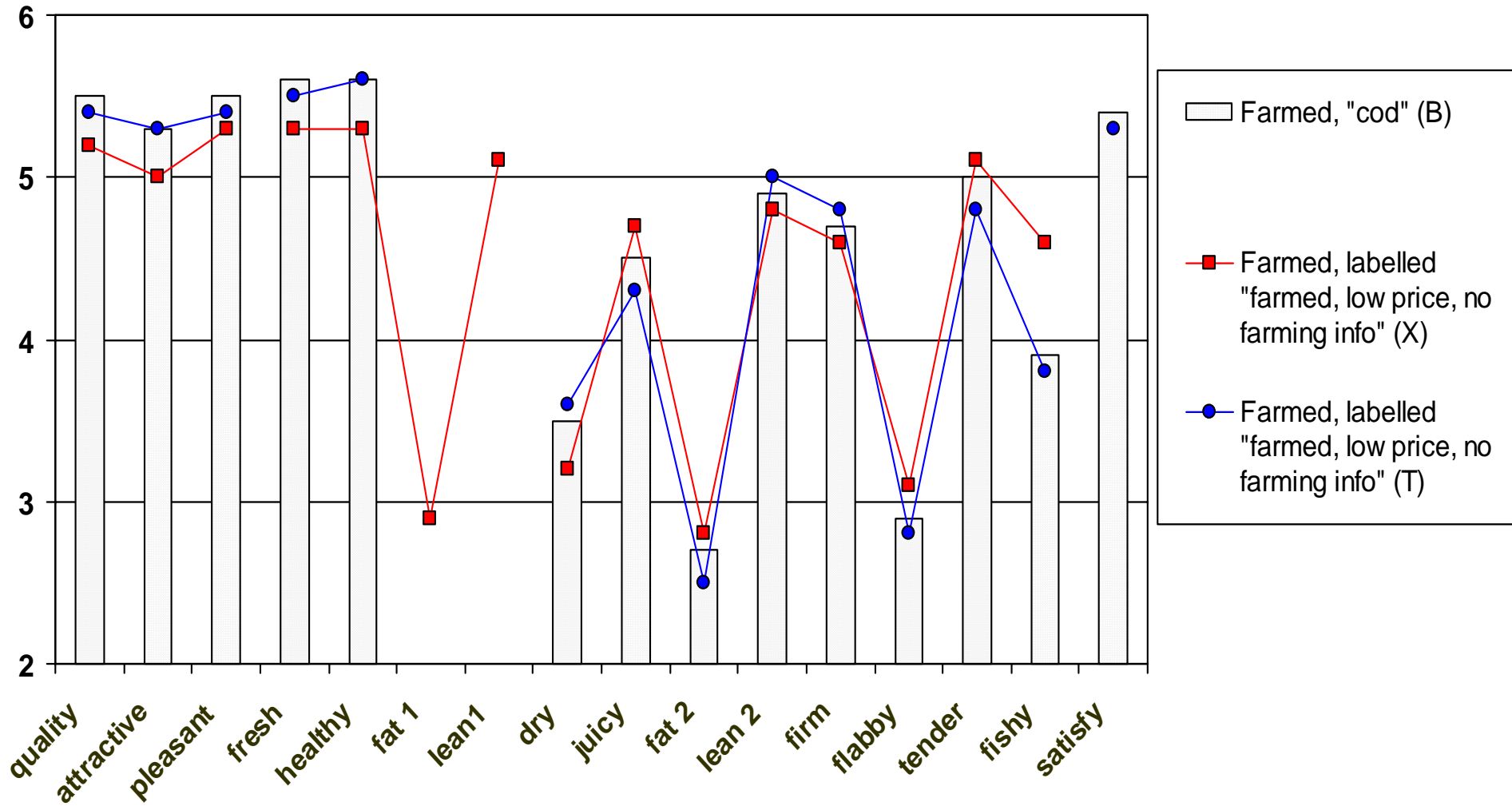




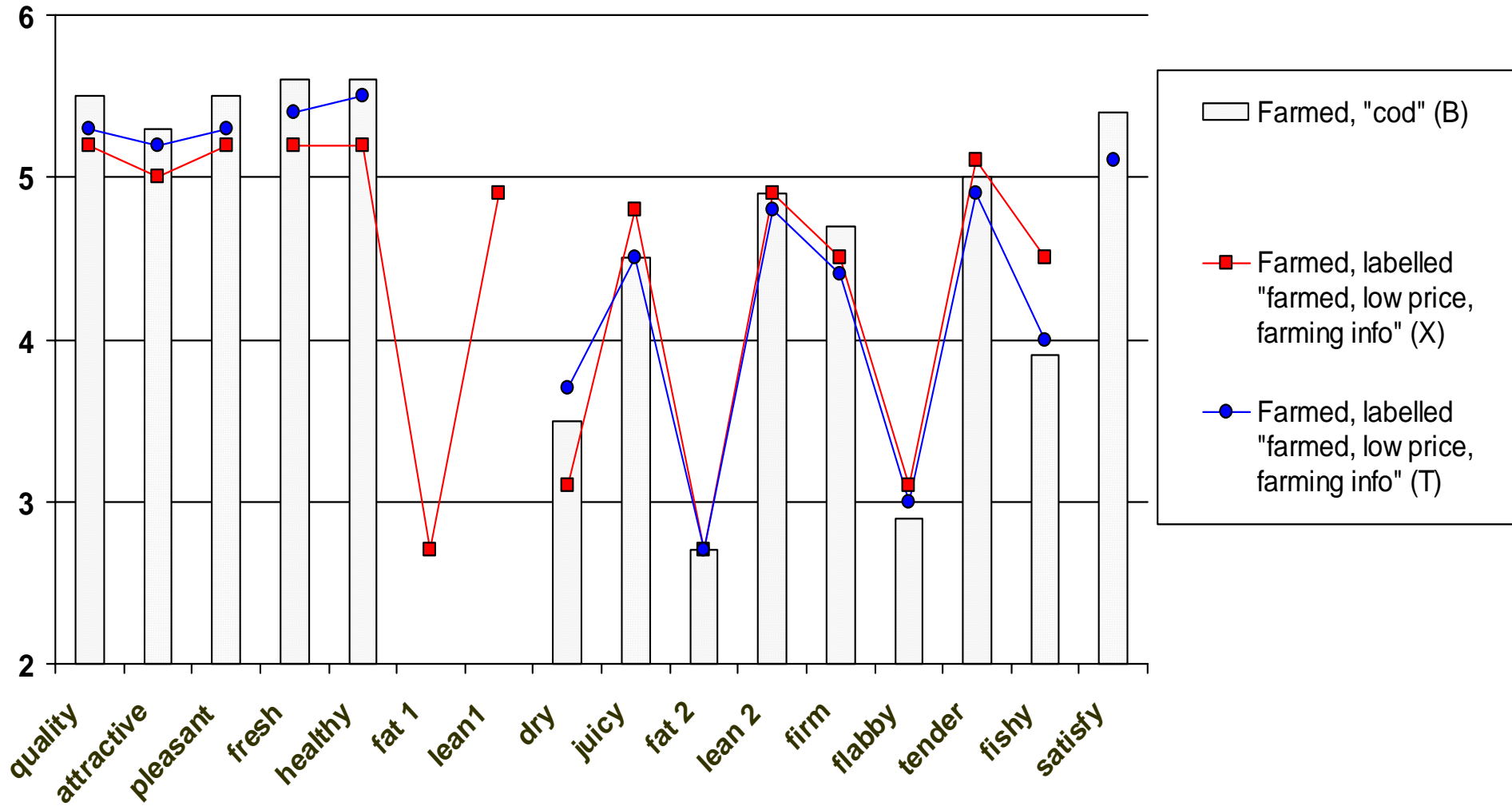
**Figure 24. Differences pre- and post consumption ratings**  
**Group C – Farmed, “high price, RIVO controlled”**



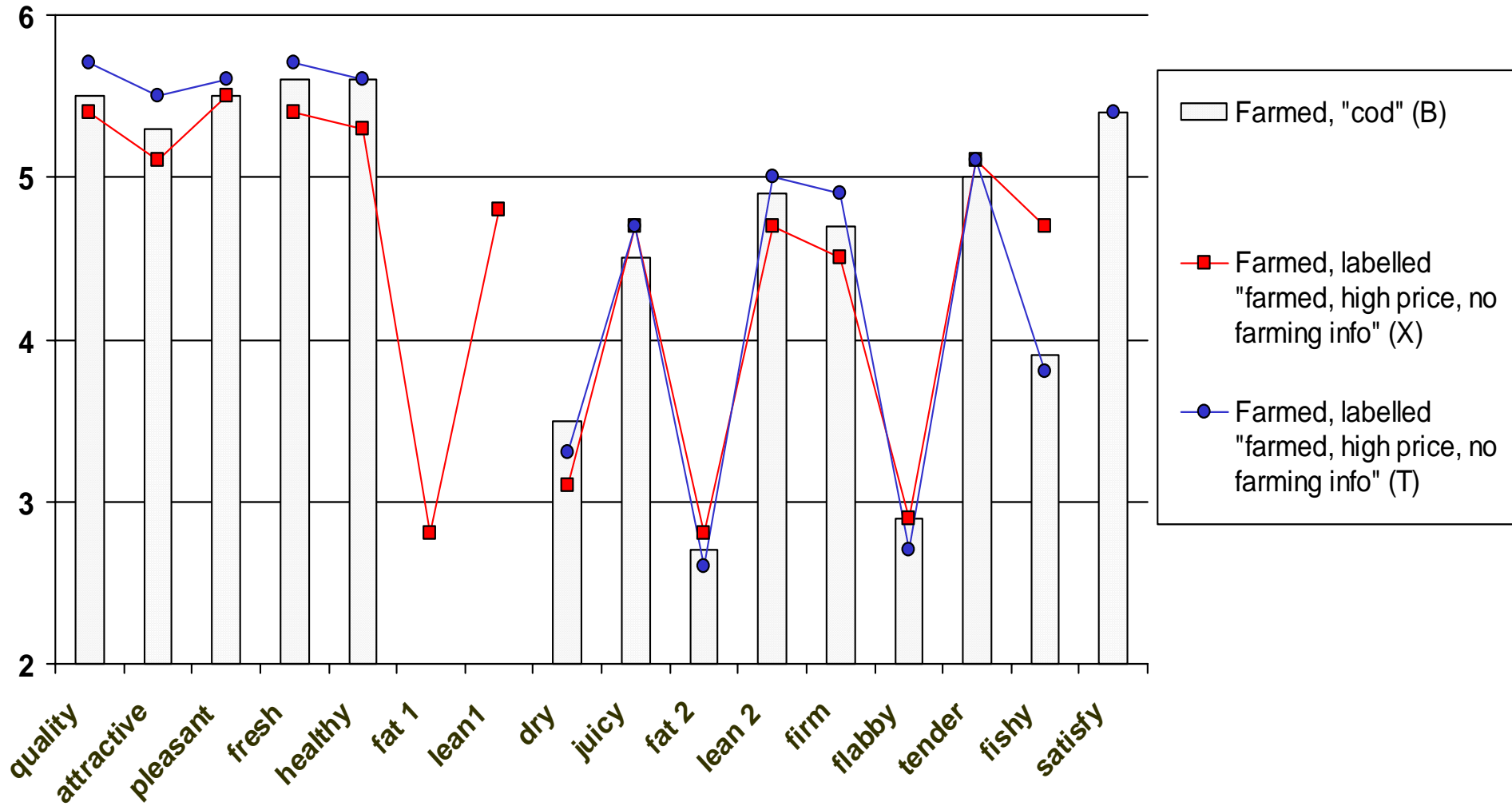
**Figure 25. Differences pre- and post consumption ratings**  
**Group D – labelled “farmed, low price, no farming info”**



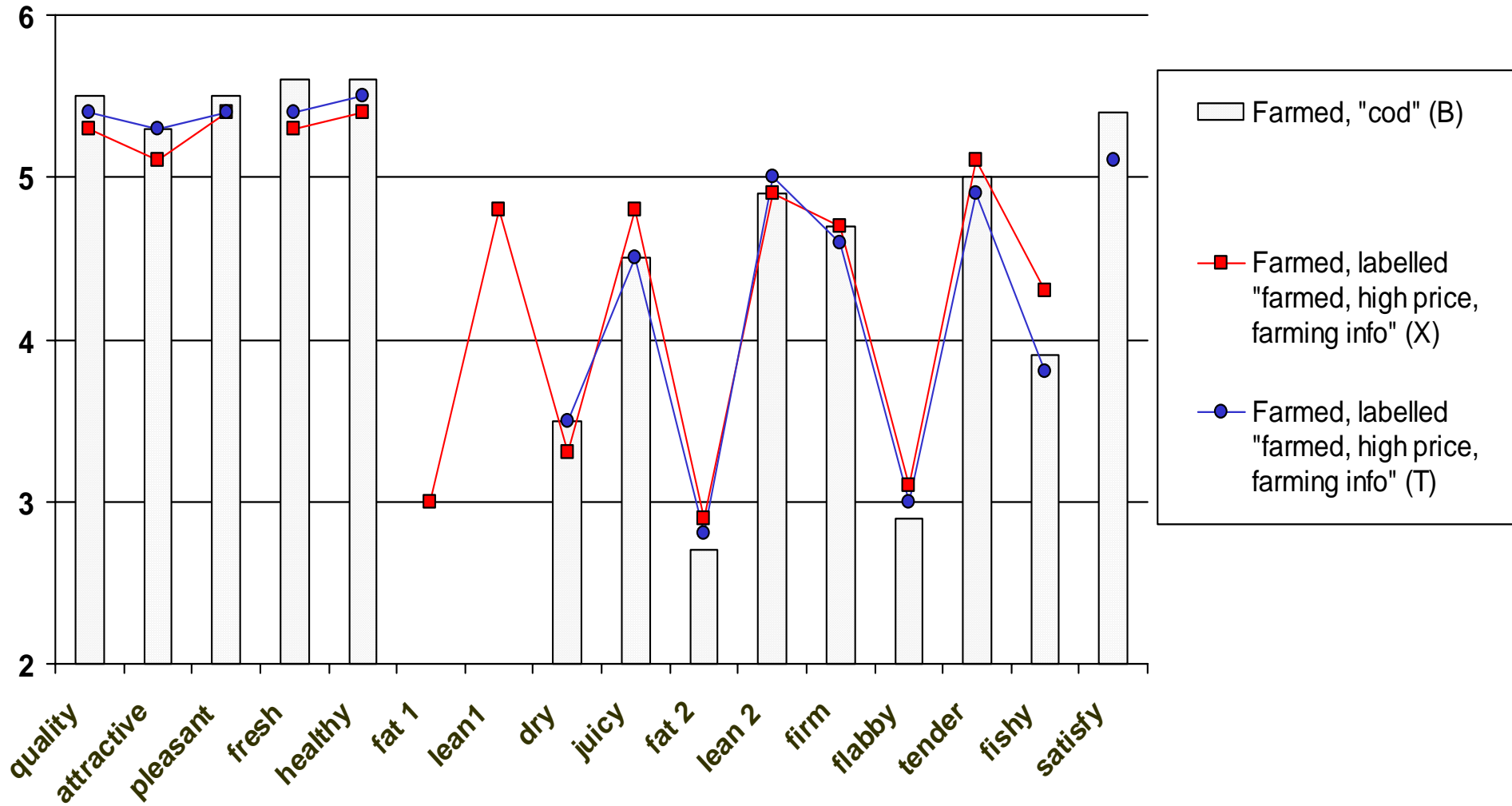
**Figure 26. Differences pre- and post consumption ratings**  
**Group D – labelled “low price, farming info”**



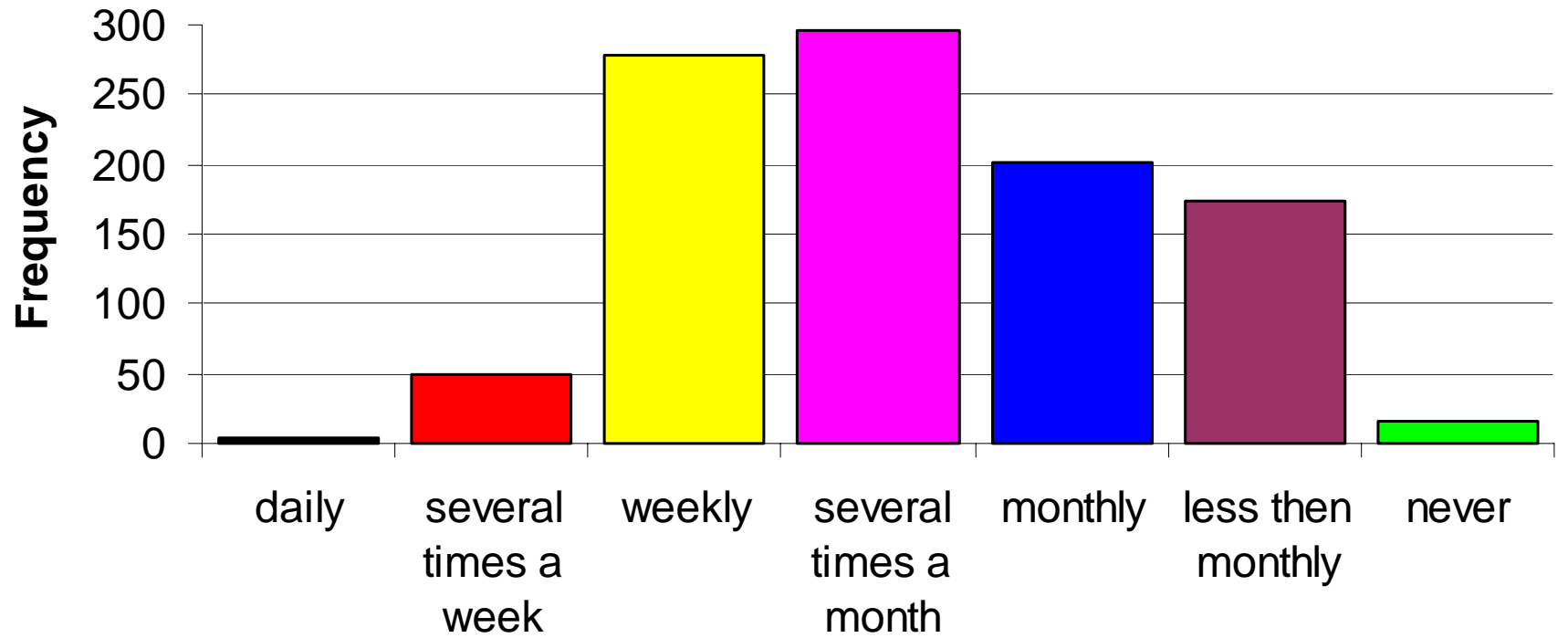
**Figure 27. Differences pre- and post consumption ratings**  
**Group D – labelled “farmed, high price, no farming info”**



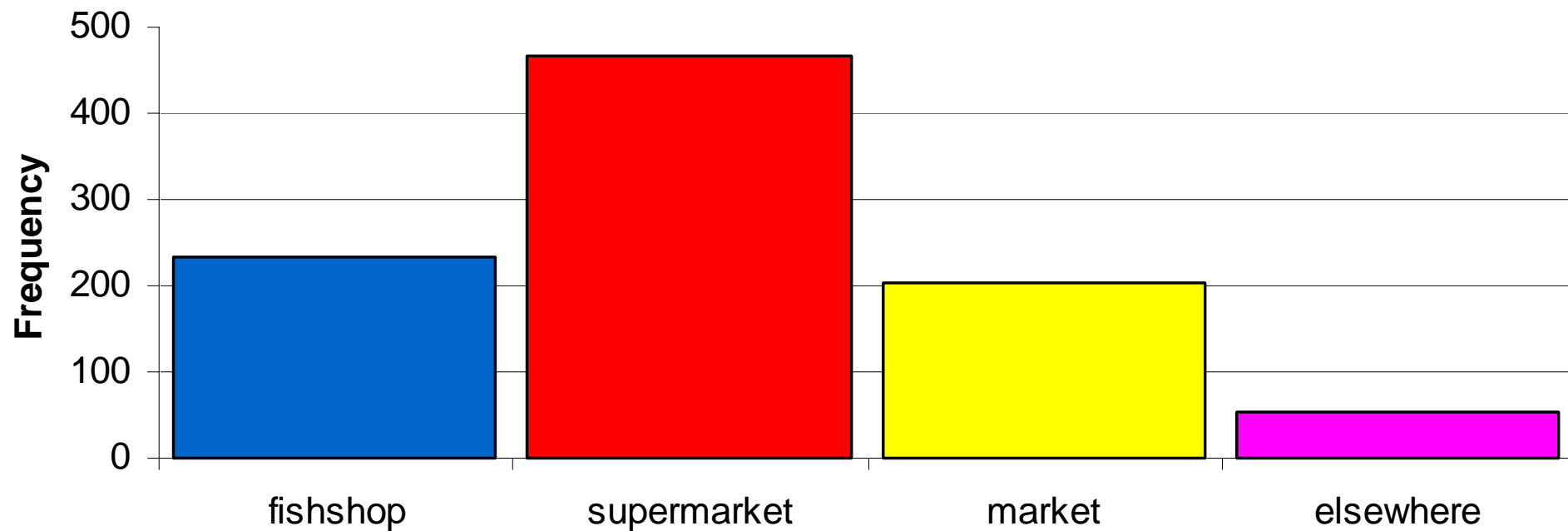
**Figure 28. Differences pre- and post consumption ratings**  
**Group D – labelled “high price, farming info”**



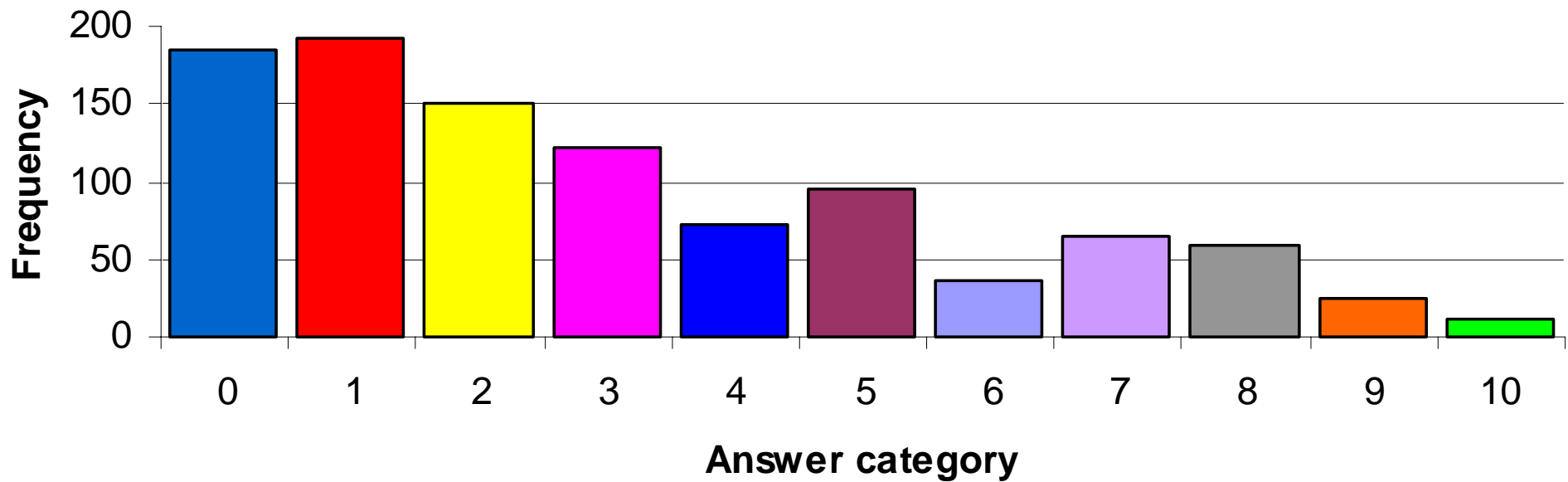
**Figure 29. How often do you usually eat fish in-home?**



**Figure 30. If you eat fish, where you usually bought it?**

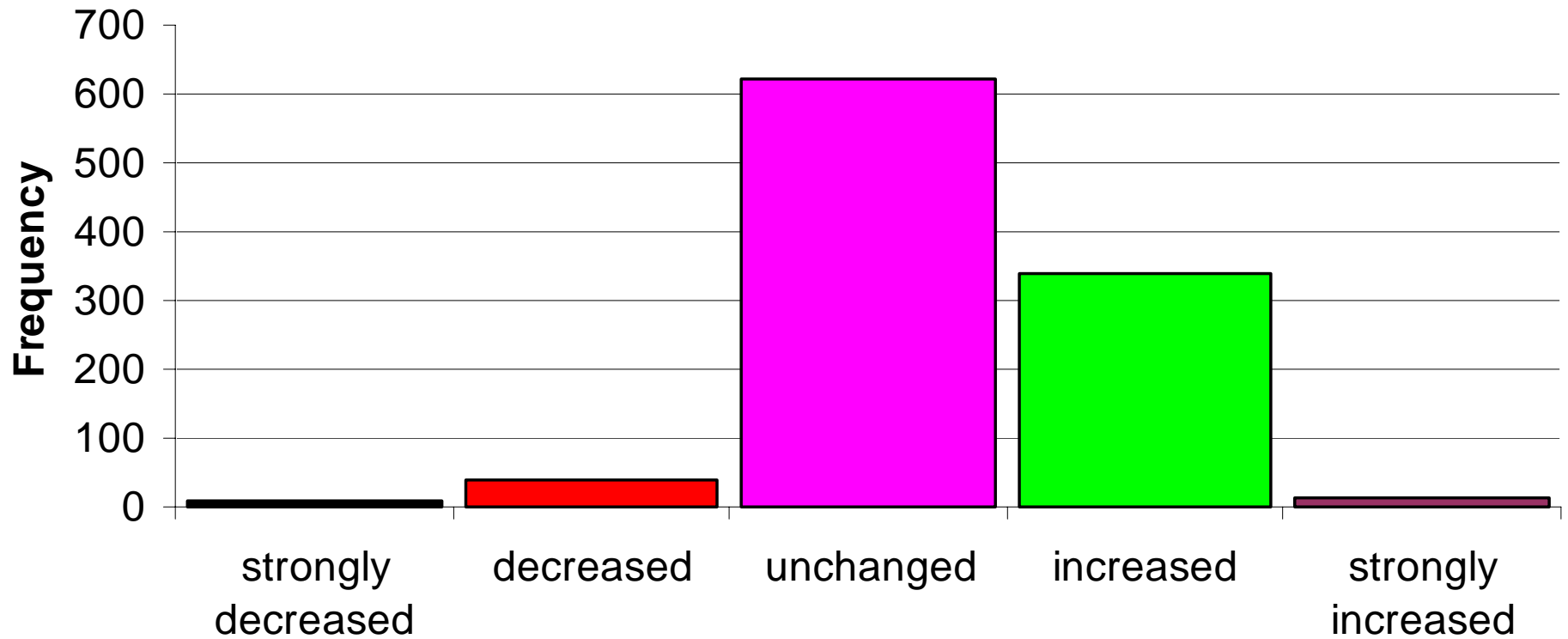


**Figure 31. How many times out of ten do you choose fish eating out-of-home?**





**Figure 32. Has the quantity of fish you eat changed over the last year?**



**Figure 33. Do you expect the quantity of fish you eat will change next year?**

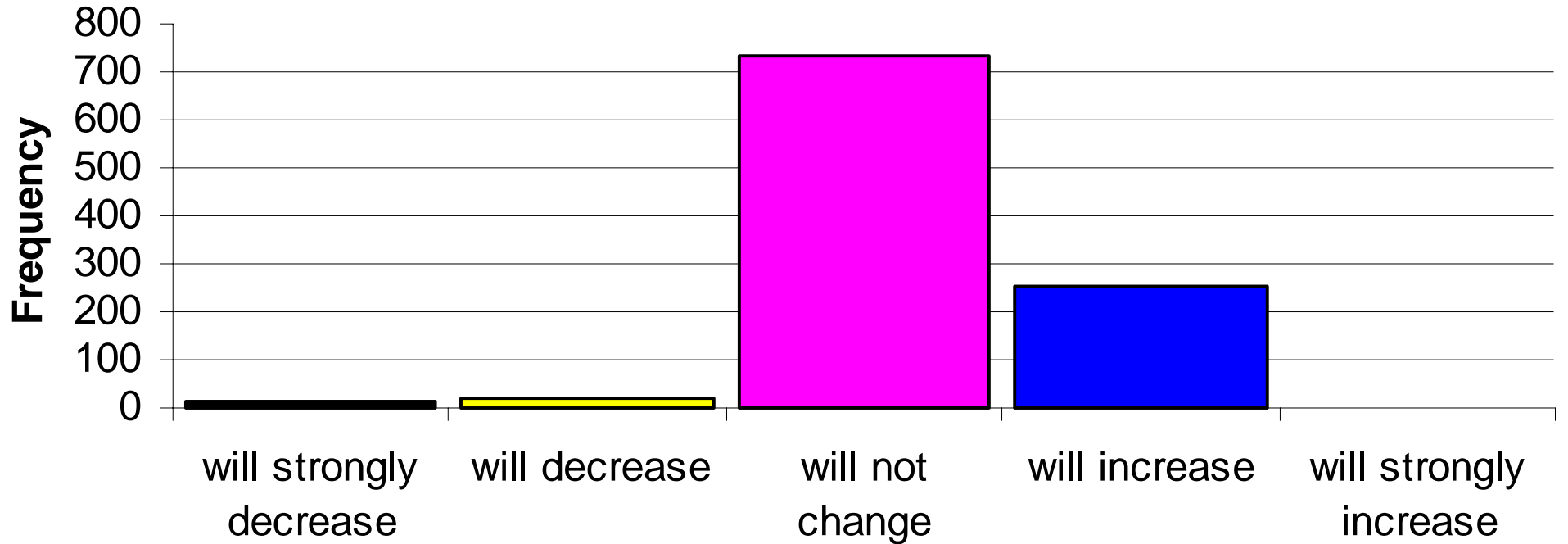
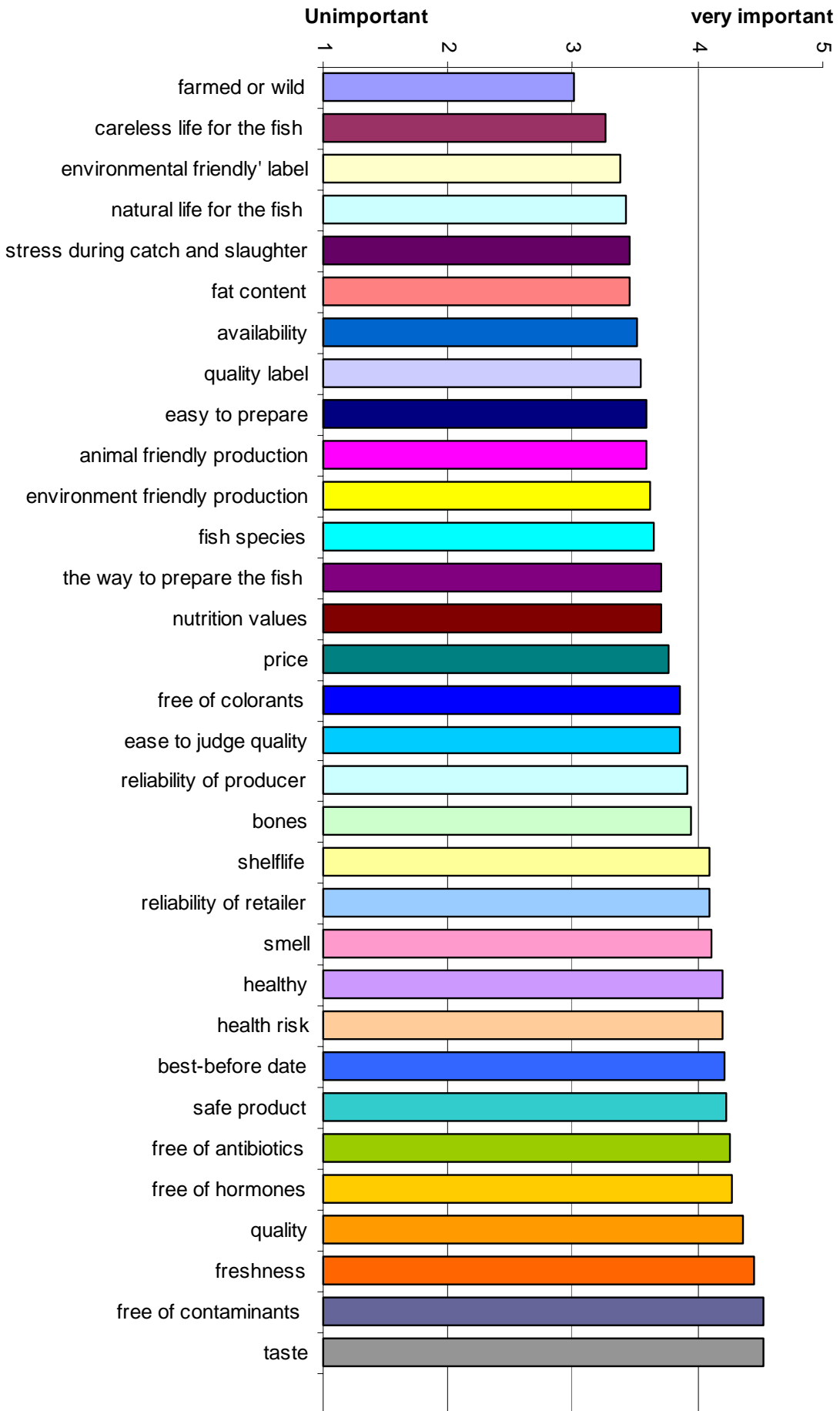


Figure 34. How important for you are the following aspects considering the fish you eat?



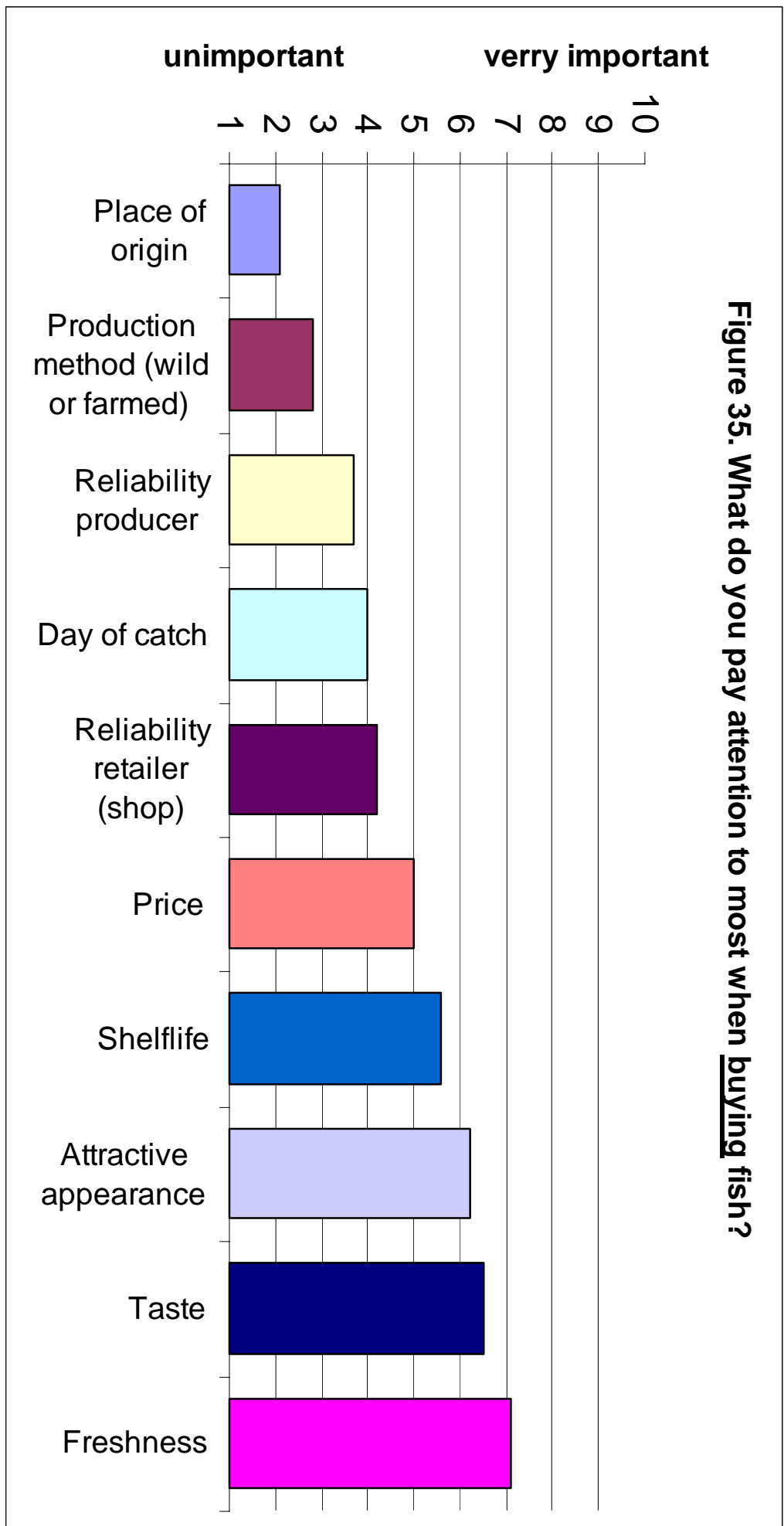


Figure 35. What do you pay attention to most when buying fish?

**Figure 36. To which production type do you associate the following aspects most?**

