Bulky feeds in the intensive fattening of goslings

II. Effects of alfalfa, grass and sugar beet pulp on abdominal fat pattern and caecal volatile fatty acid composition in geese

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SUMMARY

This study was intended to investigate effect of the inclusion of alfalfa, grass and dried sugar beet pulp meal in feed mixtures on the fatty acid composition of the abdominal fat and the caecal content of Turkish native geese. One hundred, one day old goslings of both sex were divided into 10 equal groups. The study lasted for 12 weeks, the first 6 weeks as starter period and the last 6 weeks as grower period. The starter and grower diets were replaced by 5, 10 and 15 % alfalfa meal (Group II-IV), grass meal (Group V-VII) and dried sugar beet pulp meal (Group VIII-X) during the starter period. The percents of diet replacement were 10, 20 and 30 % during the grower period, respectively. These diets were tested in comparison to a control group fed only with concentrate (Group I). Feed and water were provided ad libitum during the study. At the end of the study, six randomly selected geese from each group were slaughtered and caecal content and abdominal fat samples were taken. The percentages of total saturated, monounsaturated and polyunsaturated fatty acid of the abdominal fat were found to vary between 30.2-36.1 %, 46.6-55.2 % and 12.2-14.4 % among groups, respectively. Inclusion of alfalfa, grass and sugar beet pulp also increased the total saturated fatty acid fraction while the total monounsaturated fatty acid fraction was decreased. Inclusion of alfalfa and grass meal in the diet also caused a significant increase of the polyunsaturated fatty acid fraction except for the group which received the ration containing the lowest percentage of alfalfa, while sugar beet pulp had no significant effect on the percentage of polyunsaturated fatty acids when compared with the control. Acetic, propionic and butyric acid percentages of caecal content were found to range from 57.1 to 60.8 %, 24.0 to 26.6 % and 12.3 to 13.8 %, respectively. Inclusion of alfalfa, grass and sugar beet pulp significantly increased the percentage of caecal acetic acid, but did not affect butyric and propionic acid percentages.

KEY-WORDS : goose - alfalfa - grass - sugar beet pulp - abdominal fat pattern - caecum volatile fatty acids.

RÉSUMÉ

Aliments de lest dans l’engraissement intensif des oisons. II. Effets de la luzerne, de l’herbe et de la pulpe de betterave sur le dépôt de graisse abdominale et la composition en acides gras volatiles du caecum des oisons, Par C. ARSLAN.

Cette étude avait pour objectif d’étudier l’effet de l’inclusion de luzerne, d’herbe et de pulpe de betterave dans l’alimentation des oisons sur la composition en acides gras de la graisse abdominale et du caecum. Cent oisons âgés d’un jour et non ont été répartis en 10 groupes homogènes. L’étude a duré 12 semaines, les 6 premières semaines correspondant à la période de démarrage et les 6 dernières semaines à la période de croissance. Les régimes de démarrage et de croissance ont été substitués par des rations contenant 5, 10 et 15 % de luzerne (groupes II-IV), de l’herbe (groupes V-VII) et de la pulpe de betterave (groupes VIII-X) pendant la période de démarrage. Ces taux de substitution ont été respectivement de 10, 20 et 30 % au cours de la période de croissance. Ces régimes ont été comparés à un régime à base d’aliment concentré (groupe I). L’alimentation et l’eau étaient apportés ad libitum. À la fin de l’étude six oisons de chaque lot aléatoirement sélectionnés ont été abattus et des échantillons du contenu caecal et du gras abdominal ont été prélevés. Le pourcentage d’acides gras saturés, mono-insaturés, et poly-insaturés de la graisse abdominale a varié entre 30.2 et 36,1 %, 46.6 et 55.2 % et 12.2 et 14.4 % respectivement selon les groupes. L’inclusion de luzerne, d’herbe et de pulpe de betteraves dans la ration a augmenté de manière significative les taux d’acides gras saturés totaux du gras abdominal alors que le taux d’acides gras mono-insaturés a diminué. L’inclusion de luzerne et d’herbe dans la ration a également induit une augmentation significative de la teneur de la graisse abdominale en acides gras poly-insaturés chez tous les oisons sauf ceux qui ont reçu la ration ayant la plus faible teneur en luzerne alors que la pulpe de betterave n’a au aucun effet significatif sur la composition en acides gras polyinsaturés. Les pourcentages d’acide acétique, propionique et butyrique du contenu caecal ont été compris entre 57.1 et 60.8 %, 24.0 et 26.6 % et 12.3 et 13.8 % selon les groupes, respectivement. L’inclusion de luzerne, d’herbe et de pulpe de betterave a augmenté de manière significative la teneur en acide acétique du contenu caecal mais n’a pas affecté le pourcentage d’acide butyrique et d’acide propionique.

KEY-WORDS : oie - luzerne - herbe - pulpe de betterave - graisse abdominale - acides gras.

**Introduction**

Geese have genetic tendency towards fatness. The improvement of bird carcasses can be achieved in different ways. One of them is the feeding regime. It has been reported that inclusion of bulky feeds (i.e. alfalfa, grass, clover, corn silage) as natural stimulators to the dietary formulation could affect abdominal fatty acids composition of goose. KIRCHGESSNER et al. [9] found that total monounsaturated fatty acid (MUFA) level increased, total saturated fatty acid (SFA) level unchanged, total polyunsaturated fatty acid (PUFA) level decreased in subcutaneous fat of geese, fed on different grain plus grass given ad libitum compared with those fed with only grain. BLOTNICKA et al. [4] indicated that feed supplemented with herbal mixture did not affect goose abdominal fatty acid composition except for the linoleic acid, which was increased. They also reported that total saturated and unsaturated fatty acids in goose abdominal fat varied between 27.2-33.1 and 66.9-72.4 %, respectively.

Studies have shown that volatile fatty acids (VFA) of caecal content were either increased [5, 14], unchanged [8] or decreased [12] as the ratio of dietary fibre increased.

The aim of the present study was to investigate the influence of diets gradually replaced by alfalfa, grass and dried sugar beet pulp meal on the fatty acid composition of the abdominal fat and the caecal content of Turkish native geese.

**Materials and methods**

**ANIMALS, DIETS AND MANAGEMENT**

One hundred, unsexed, one day old Turkish native geese chicks were randomly assigned into ten dietary treatment groups. The study lasted for 12 weeks, with first 6 weeks as starter period and the last 6 weeks as grower period. One of the groups was fed with only concentrate prepared for starter and grower diet (Group I = Control) to meet National Research Council [10] recommendations for geese (Table I). These diets were replaced by 5, 10 and 15 % of alfalfa meal (Group II, III, IV), grass meal (Group V, VI, VII) and dried sugar beet pulp meal (Group VIII, IX, X) at starter period. The percentages of the bulky raw material was 10, 20, 30 % during the grower period. Diets were offered to animals in mash form, feed and water was available at all times during the experimental period.

**SAMPLE COLLECTION**

At the end of the study, 6 geese were randomly selected from each group for slaughter. After slaughter, caecal content was immediately taken from caecum and processed according to the procedure of PARKER and Mc MILLAN [11]. The abdominal fats were taken 2 hours after slaughter from carcasses, labelled and stored in deep freeze at - 20 °C until analysis.

**CHEMICAL ANALYSIS**

The proximate analysis of the feed samples were carried out according to the methods of AOAC [2]. Abdominal fats oil fractions were determined using ether extraction method [1]. These oil samples were esterified [2] and the concentration of the fatty acids were determined by gas chromatography (Thermoquest Trace GC) in TÜBITAK Marmara Research Centre, Koceli, Turkey. The gas chromatography equipped with a flame ionisation detector and a SP-2330 fused silica capillary column 30 m x 0.25 mm I.D. x 0.20 µm film thickness. The temperature of column, detector and injector were adjusted to 220°C, 250°C and 240°C, respectively. Helium was used as carrier gas and of which flow speed was adjusted 30 ml/minute. Gas flow speed used was adjusted as H2=35 ml/minute and dry air = 350 ml/minute. Qualitative determination of fatty acid methyl esters of samples were made by comparing the relative retention times obtained from fatty acid methyl ester standards provided from Sigma (St. Louis, USA).

The concentrations of individual volatile fatty acid (VFA) components of caecal content were measured by the pre-cited laboratory by gas chromatography. The gas chromatography equipped with a flame ionisation detector and a CP-WAX fused silica capillary column 25 m x 0.32 mm I.D. x 0.20 µm film thickness. The temperature of column, detector and injector were 180°C, 270°C and 250°C, respectively. Helium was used as the carrier gas and of which flow speed was adjusted 30 ml/minute and dry air = 350 ml/minute. Qualitative determination of volatile fatty acid salts of samples were made by comparing the relative retention times obtained from fatty acid standards provided from Sigma (St. Louis, USA).

**STATISTICS**

Data were subjected to analysis of variance using one-way ANOVA procedures in SPSS [13]. A Duncan Multiple Range Test was performed when significant values were obtained. Values were expressed as mean ± standard error (SE).

**Results**

Saturated (SFA) and monounsaturated fatty acids (MUFA) were predominant, whereas polyunsaturated fatty acids (PUFA) were relatively low in abdominal fat of all groups (Table II). The major SFA were palmitic and stearic acid, the major MUFA was oleic acid and the major PUFA was linoleic acid. Total SFA was significantly lower in the control group than other groups (P < 0.001), while MUFA percentage was greater in control group. Inclusion of alfalfa and grass meal in the diet caused a significant increase (P < 0.001) in PUFA fraction in all groups except group II, while sugar beet pulp had no significant effect on polyunsaturated fatty acids percentage when compared to control.

The major volatile fatty acids of the caecum were acetic acid followed by propionic and butyric acids (Table III). Acetic acid percentage varied between 57.1 and 60.8 % according to the groups and feeding bulky feeds significantly.
increased acetic acid percentage when compared with control (P < 0.01). Propionic acid percentage ranged 24.3 to 26.6 %
according to the groups and bulky feeds did not significantly affect propionic acid percentage when compared to control
(P = 0.079). Butyric acid percentage were not significantly increased by bulky feeds ranging from 12.5 to 13.8 % among the groups (P = 0.057).

Discussion

It is noticed that saturated and monounsaturated fatty acids percentage were higher than polyunsaturated fatty acid percentage in abdominal fat. In general, fatty acids incorporated into lipids derive from two different sources, either from food or from de novo synthesis [6]. In the present study, fatty acids incorporated predominantly derive from de novo synthesis from carbohydrates, due to the low fat concentration and the high carbohydrate concentration of the diets. Majority of saturated and monounsaturated long chain fatty acids are the products of de novo fatty acids synthesis from carbohydrates. Polyunsaturated fatty acids incorporated into tissue lipids derive from food [6]. Therefore, a high de novo synthesis fatty acids explains higher levels of saturated (SFA) and monounsaturated fatty acids (MUFA) than polyunsaturated fatty acids (PUFA).

Alfalfa, grass and sugar beet pulp inclusion in diet, increased total SFA level whereas it decreased MUFA levels. All alfalfa and grass meal groups showed an increase in PUFA levels, except for the group which received the lowest percentage of alfalfa inclusion. Oppositely, sugar beet pulp inclusion did not affect PUFA levels when compared with control. The ratio of total SFA to PUFA levels were lower in grass meal groups when compared with other groups. The decrease in the SFA/PUFA ratio might be attributed to lower metabolisable energy content of grass meal leading to a decrease in de novo synthesis due to lack of glucidic substrate.
It is noticed that the linolenic acid, an ω-3 fatty acid, showed significant increase in alfalfa and grass meal groups when compared with control. On the other hand, bulky feed inclusion resulted in a significant decrease in MUFA levels, which may not be favourable. The values of the fatty acid levels obtained in this study are in accordance with those of others [3, 4, 9].

Although the feeding regime did not statistically affect caecal propionic and butyric acid percentage, acetic acid percentage was significantly higher in all bulky feed groups than control. Proportional increase of alfalfa, grass and sugar beet pulp in the diet resulted in a harmonious increase in the caecal content was increased and propionic acid decreased when dietary fibre increased in geese diet. The caecal volatile fatty acid concentrations in the present study were consistent with those of HAN and SHAO [7], TIMMLER [14], and HSU et al. [8], but higher than those of SAVORY and KNOX [12].

In conclusion, inclusion of alfalfa, grass and sugar beet pulp meal in diet increased total saturated fatty acids, but decreased monounsaturated fatty acids percentage of abdominal fat of geese. The percentage of polyunsaturated fatty acids of the abdominal fat tended to increase in all geese except for those which received sugar beet pulp. Inclusion of alfalfa, grass and sugar beet pulp in diet increased acetic acid and did not change propionic and butyric acid percentage of caecal content of geese, suggesting the advantage of bulky raw material introduction on goose fat composition.

** : P < 0.01
a,b,c,d,e : Means in the same row with different letters statistically differ (** : P < 0.01, *** : P < 0.001)
References


ERRATUM :

About the first part of this article : Effects of grass, alfalfa and sugar beet pulp on growth slaughter performance and some blood parameters in geese.

In summary :
- line 8 : add : «from each group» after «selected geese»

In Introduction :
- line 5 : add : «from» after «utilising»

In Materials and methods :
* Animals, diets and management
- line 2 : after «dietary treatement» add : (10 goslings in each)

In table 1 legend :
- line 5 : add : «119 ng» after «Choline chloride»

In Results and discussion :
- line 47 : read : «Group II, V and VIII»

In References :
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