Data Article

Dataset on the content of vitamin D₃ and 25-hydroxyvitamin D₃ in 40 pork (Breitov breed) commodities

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Article history:
Received 29 December 2021
Revised 2 April 2022
Accepted 4 April 2022
Available online 9 April 2022

Dataset link: Dataset on the content of vitamin D₃ and 25-hydroxyvitamin D₃ in 40 pork (Breitov breed) commodities (Original data)

Keywords:
Vitamin D₃
25-hydroxyvitamin D₃
25OHD₃
HPLC
Pork
Food analysis

Abstract

This dataset demonstrates the content of vitamin D₃ and 25-hydroxyvitamin D₃ (25OHD₃) in boiled, grilled, and raw pork for both lean and whole cuts including ribs, tenderloin, shoulder, neck, belly, and center chops. Total fat content in raw pork cuts was determined by the gravimetric method. Quantification analysis using reverse phase high performance liquid chromatography with UV-DAD connected. Purification of fatty acids from proteins was performed using a c18 cartridge, resolving vitamin D₃ from its metabolites by subjecting purified samples to polar silica cartridge, purification from sugars by a series of two amino columns, and quantification of vitamin D₃ and 25-hydroxyvitamin D₃ by injecting purified extracts on C18 SPE column. Grilling samples was conducted in an electric combi oven.

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### Specifications Table

| Subject | Food Science: Food Chemistry |
|---------|------------------------------|
| Specific subject area | Food analysis, vitamin D<sub>3</sub> and 25-hydroxyvitamin D<sub>3</sub> content in pork |
| Type of data | Table |
| How the data were acquired | Nexera X3 UHPLC 3.0 (Shimadzu, Japan) |
| | Electric combi oven (FlexFusionTM Henny Penny, USA) |
| | SPE column, CHROMABOND C18 (45 μm, 3 mL/500 mg, CHROMABOND®, Norcross, USA) |
| | SPE columnSilica cartridge Supelcosil LC-Si 5 (μm, 15.0 cm × 4.6 mm, Supelco®, Bellefonte, USA) |
| | SPE column, amino column Supelcosil (5 μm, 15.0 cm × 4.6 mm, Supelco®, Bellefonte, USA) |
| | SPE column RP C18 (Synergy hydro-RP, 4.6 × 250 mm, 4.0 μm, Phenomenex Incorporation, USA) |
| | SPD-M20A Photodiode Array Detector (Shimadzu, Japan) |
| | ChromQuest 4.2.34 software for data collection and quantification |
| | The detection at 265 nm |
| | Pyrogallol (American chemical society grade) |
| | Petroleum ether (American chemical society grade, boiling range 24–24 C) |
| | Diethyl ether (HPLC grade) |
| | Potassium Hydroxide (KOH, HPLC grade) |
| | n-hexane (HPLC grade) |
| | Methanol (CH3OH, HPLC grade) |
| | Ethanol (C2H5OH, HPLC grade) |
| | Ascorbic acid (C6H8O6, American chemical society grade) |
| | Dichloromethane (CH<sub>2</sub>Cl<sub>2</sub>, HPLC grade) |
| | 2-propanol (C3H8O, HPLC grade) |
| | Cholecalciferol (vitamin D3) standard (HPLC grade) |
| | Ergocalciferol (vitamin D2) standard (HPLC grade) |
| | 25 Hydroxyvitamin D3 standard (HPLC grade) |
| | Hydrochloric acid (HCl, 8 M) |
| | Deerna Meat Grinder DEM-JR01 (Xiaomi Mi, China) |
| Data format | Raw and Analyzed data |
| Description of data collection | Pork samples used in this study were obtained from a 6 months old male pig bel to (Breitov breed) and had a carcass weight of 67.8 kg. |
| | Common lean and whole cuts (ribs, tenderloin, shoulder, neck, belly, center chops) were boiled, grilled, or kept raw and separated into lean and whole cuts. |
| | Lean samples: separated fats are removed and intermuscular fats were kept; Whole samples: are pork cuts without removing fat. |
| | The data on the contents of 250HD<sub>3</sub> and vitamin D<sub>3</sub> were obtained by UHPLC according to Bilodeau et al. [1, 2] with a slight modification. |
| | Pork boneless lean and whole cuts were grilled inside an electric combi oven (FlexFusionTM Henny Penny, USA). |
| | The data on the total content of fat in lean and whole cuts by the gravimetric method through solvent extraction after hydrochloric acid hydrolysis [3]. |
| Data source location | Russian economic University. G. V. Plekhanova, Stremyanny avenue, 36, Moscow, 115093, Russia |
| | Institution: Plekhanov Russian University of Economics |
| | Latitude and longitude for collected samples: 55.7273, 37.6254 |
| Data accessibility | 1. With the article: |
| | Raw data (Supplementary material) |
| | Mean and the Standard Error of Mean (SEM) of the experimental data are available in this article in Tables (1 and 2) |
| | 2. Data repository: |
| | Repository Name: figshare |
| | Data identification number: 10.4121/17269247 |
| | Direct URL to data: https://figshare.com/s/e0c4a108530e7be1fcad |
Value of the Data

- This data is useful for positioning the primary contents of both vitamin D₃ and 25OHD₃ in different pork cuts.
- This data compares the content of vitamin D₃ and 25OHD₃ in lean and whole pork cuts subjected to boiling, grilling, and raw samples.
- This dataset provides additional information about 40 different pork commodities that would help fill the knowledge gaps regarding vitamin D₃ and 25OHD₃ contents of foodstuffs.
- This dataset can help nutritionists and nutrition-related applications in advising daily meal plans.

1. Data Description

Data provided in Table 1 was generated from 40 different pork commodities regarding the contents of vitamin D₃ and 25OHD₃ in lean and whole pork cuts subjected to boiling and grilling along with raw samples. Common cuts chosen for the analysis are: ribs, tenderloin, center chops, shoulder (blade), neck, belly (side), lean, and extra-lean grounded pork samples. Vitamin D₃ and 25OHD₃ were determined by HPLC with an analytical procedure as follows: (1) direct saponification; (2) extraction of the unsaponified partitions; (3) purification of the unsaponified fractions by C18, silica, and amino solid-phase extraction columns (SPE); (4) Quantification was performed by injecting purified extracts on RP C18 SPE column.

Data provided in Table 2 demonstrates the total fat content in lean and whole raw pork cuts samples.

Table 1
Vitamin D₃ and 25-hydroxyvitamin D₃(mg/100 g; mean∗ (range; SEM)) in raw, boiled, and grilled pork commodities separated into lean and whole cuts.

| Pork sample          | Vitamin D₃ (mg/100 g) | 25-hydroxyvitamin D₃ (mg/100 g) | N* |
|----------------------|-----------------------|---------------------------------|----|
| Lean ground pork     | raw                   | 0.322 (0.31–0.346; 0.012)       | 0.326 (0.292–0.352; 0.018) | 3 |
| Lean ground pork     | boiled                | 0.225 (0.22–0.23; 0.003)        | 0.173 (0.158–0.182; 0.007) | 3 |
| Extra lean ground pork | raw                 | 0.24 (0.23–0.25; 0.007)        | 0.222 (0.212–0.228; 0.005) | 3 |
| Extra lean ground pork | boiled              | 0.13 (0.11–0.15; 0.011)        | 0.103 (0.092–0.125; 0.011) | 3 |
| Center chops         | Lean raw              | 0.245 (0.24–0.25; 0.005)        | 0.232 (0.221–0.247; 0.008) | 2 |
| Center chops         | Lean boiled           | 0.21 (0.2–0.22; 0.010)         | 0.226 (0.211–0.242; 0.009) | 2 |
| Center chops         | Lean grilled          | 0.202 (0.19–0.21; 0.008)       | 0.073 (0.068–0.074; 0.003) | 2 |
| Center chops         | Whole raw             | 0.346 (0.33–0.36; 0.014)       | 0.367 (0.341–0.393; 0.015) | 2 |
| Center chops         | Whole boiled          | 0.299 (0.318–0.28; 0.019)      | 0.247 (0.26–0.248; 0.008) | 2 |
| Center chops         | Whole grilled         | 0.231 (0.23–0.23; 0.001)       | 0.244 (0.232–0.254; 0.006) | 2 |
| Tenderloin           | Lean raw              | 0.049 (0.047–0.051; 0.001)     | 0.073 (0.07–0.079; 0.003) | 3 |
| Tenderloin           | Lean boiled           | 0.045 (0.042–0.045; 0.003)     | 0.04 (0.034–0.045; 0.003) | 3 |
| Tenderloin           | Lean grilled          | 0.019 (0.015–0.021; 0.002)     | 0.02 (0.017–0.022; 0.001) | 3 |
| Tenderloin           | Whole raw             | 0.208 (0.192–0.238; 0.015)     | 0.241 (0.224–0.265; 0.012) | 2 |
| Tenderloin           | Whole boiled          | 0.173 (0.169–0.177; 0.002)     | 0.196 (0.172–0.235; 0.020) | 2 |
| Tenderloin           | Whole grilled         | 0.111 (0.101–0.124; 0.007)     | 0.075 (0.072–0.81; 0.030) | 3 |
| Ribs                 | Lean raw              | 0.1296 (0.126–0.136 0.003)     | 0.143 | 3 |
| Ribs                 | Lean boiled           | 0.104 (0.076–0.156 0.026)      | 0.106 (0.102–0.111; 0.003) | 3 |
| Ribs                 | Lean grilled          | 0.0783 (0.067–0.096 0.009)     | 0.075 (0.065–0.089; 0.007) | 3 |
| Ribs                 | Whole raw             | 0.183 (0.166–0.215; 0.016)     | 0.264 (0.258–0.269; 0.003) | 3 |
| Ribs                 | Whole boiled          | 0.113 (0.101–0.127; 0.008)     | 0.138 (0.13–0.151; 0.007) | 2 |
| Ribs                 | Whole grilled         | 0.091 (0.065–0.115; 0.014)     | 0.232 (0.192–0.262; 0.021) | 3 |
| Shoulder (blade)     | Lean raw              | 0.207 (0.202–0.212; 0.005)     | 0.288 (0.235–0.344; 0.032) | 2 |
| Shoulder (blade)     | Lean boiled           | 0.148 (0.142–0.154; 0.006)     | 0.165 (0.151–0.166; 0.008) | 2 |
| Shoulder (blade)     | Lean grilled          | 0.124 (0.127–0.136; 0.005)     | 0.113 (0.111–0.115; 0.001) | 2 |

(continued on next page)
Table 1 (continued)

| Pork sample         | Vitamin D3 (mcg/100 g) | 25-hydroxyvitamin D3 (mcg/100 g) | N* |
|---------------------|-------------------------|----------------------------------|----|
| Shoulder (blade)    | Whole raw 0.307 (0.295–0.32; 0.013) | 0.337 (0.33–0.338; 0.004) | 2  |
| Shoulder (blade)    | Whole boiled 0.218 (0.23–0.206; 0.012) | 0.226 (0.22–0.237; 0.005) | 2  |
| Shoulder (blade)    | Whole grilled 0.197 (0.194–0.201; 0.004) | 0.137 (0.134–0.141; 0.002) | 2  |
| Neck                | Lean raw 0.07 (0.062–0.078; 0.008) | 0.15 (0.41–0.167; 0.009) | 3  |
| Neck                | Lean boiled 0.071 (0.065–0.078; 0.007) | 0.077 (0.064–0.089; 0.007) | 3  |
| Neck                | Lean grilled 0.042 (0.04–0.045; 0.003) | 0.107 (0.072–0.12; 0.018) | 3  |
| Neck                | Whole raw 0.175 (0.17–0.181; 0.005) | 0.232 (0.224–0.248; 0.008) | 3  |
| Neck                | Whole boiled 0.161 (0.16–0.162; 0.001) | 0.205 (0.183–0.24; 0.018) | 3  |
| Neck                | Whole grilled 0.122 (0.12–0.125; 0.003) | 0.081 (0.072–0.086; 0.004) | 3  |
| Belly (side)        | Lean raw 0.072 (0.067–0.08; 0.004) | 0.105 (0.095–0.121; 0.008) | 3  |
| Belly (side)        | Lean boiled 0.081 (0.077–0.08; 0.003) | 0.081 (0.064–0.09; 0.009) | 3  |
| Belly (side)        | Lean grilled 0.067 (0.065–0.71; 0.002) | 0.094 (0.087–0.09; 0.004) | 3  |
| Belly (side)        | Whole raw 0.347 (0.324–0.376; 0.015) | 0.338 (0.334–0.345; 0.003) | 3  |
| Belly (side)        | Whole boiled 0.334 (0.332–0.339; 0.002) | 0.275 (0.27–0.283; 0.004) | 3  |
| Belly (side)        | Whole grilled 0.175 (0.241–0.262; 0.076) | 0.18 (0.176–0.187; 0.004) | 3  |

N*: number of repetitions.

Table 2
Total fat content in lean and whole raw pork samples (wt%; range; SEM).

| Pork sample                           | Total fat content                     |
|---------------------------------------|---------------------------------------|
| Lean ground pork                      | 11.20 (10.25–12.74; 0.724)            |
| Extra-lean ground pork                | 4.71 (4.25–5.61; 0.30)                |
| Center chops                          | 2.84 (2.38–3.21; 0.188)               |
| Center chops                          | 13.45 (12.38–114.88; 0.512)           |
| Tenderloin                            | 3.60 (3.39–3.82; 0.091)               |
| Ribs                                  | 6.01 (5.67–6.65; 0.225)               |
| Ribs                                  | 13 (12.12–13.81; 0.355)               |
| Shoulder (blade)                      | 20.64 (17.23–22.92; 1.317)            |
| Shoulder (blade)                      | 13.6 (13.27–14.48; 0.293)             |
| Neck                                  | 20.05 (18.08–21.6; 0.823)             |
| Neck                                  | 3.78 (3.22–4.79; 0.346)               |
| Neck                                  | 8.23 (6.87–9.35; 0.519)               |
| Belly (side)                          | 23.51 (21.63–25.53; 0.866)            |
| Belly (side)                          | 30.27 (28.58–31.63; 0.632)            |

Number of repetitions (N = 4).

2. Experimental Design, Materials and Methods

Pork meat used in this study was obtained from a male pig (Breitov breed), brought from the licensed slaughterhouse (Arian, Moscow, Russia) on the 8th of November 2021 in when it was around 6 months old and had a carcass weight of 67.8 kg.

Common cuts were chosen for the analysis including ribs, tenderloin, shoulder (blade), neck, belly (side), and center chops. The mixture from all the previously mentioned cuts was used for making lean and extra-lean ground pork samples. Bones were removed from all cuts, then cuts were placed in plastic containers provided with absorbent tray pads at the bottom and then frozen at −18 °C for 24 h before analysis.

2.1. Grilling

Dissection and separating of lean meat from connective tissues and adhering fat parts took place exactly before grilling. Pork boneless cuts were separated from each other's on metal trays
and placed in a preheated Electric combi oven (FlexFusion™ Henny Penny, USA). Samples were steamed for 30 min at a temperature of 220 °C.

2.2. Boiling

Each mass was cut into approximately 100 g pork cuts. Samples were obtained either by cubing the meat by cutting muscle fibers horizontally or slicing them by vertically cutting fibers. Samples were placed in a pan and boiled for 90 min with 1 L tap water (pH=7.18). No additives were added.

2.3. Analysis of 25OHD₃ and vitamin D₃

2.3.1. Samples preparation

Analysis was performed in a closed laboratory without windows provided with special covered lamps. Nitrogen (N₂) gas was used to replace air before the saponification step.

Ergocalciferol (vitamin D₃) 99% and 25-hydroxyvitamin D₃ (25OHD₃) 99% (Merck KGaA, Darmstadt, Germany) both were of HPLC grades and served as standards.

Measures such as pre-cooling the sample were taken into account to eliminate the effect of the temperature rise during this procedure. Samples prepared for the test were analyzed without delay and protected from light.

2.3.2. Saponification

A sample size of 50 g for each body part was thoroughly ground in a suitable mill and well mixed. Approximately 50 mg of the homogenized sample was transferred into a 10 ml glass test tube equipped with a proper cap. 3 mL of 96% Ethanol and 0.15 mL 95% KOH, 100 mL 1% pyrogallol, 0.25 mg ascorbic acid, 0.1 mL of Cholecalciferol 99% and 0.1 mL of Ergocalciferol 99% as internal standards were added and shaked for 2 min. The tube was transferred into 80 °C water bath and kept for 40 min. The cap was sealed up and 1 mL of bi-distilled water and 3 mL of n-hexane were added and then gently shaked.

The saponified mixture was centrifuged at 8000 rpm for 5 min. The top layer was collected and the extraction was performed again for better results with 3 mL of n-hexane without water and then centrifuges.

2.3.3. Purification

Samples were washed in the hexane phase with 2 mL of bi-distilled water followed by centrifugation. The aqueous phase was separated and discarded. And 1 mL of 99.9% 2-propanol was added to the washed hexane phase. Samples were purified with solid-phase extraction (SPE) columns. The procedure was performed under a flow of nitrogen gas.

Purification of fatty acids of the samples from proteins was performed using a C18 cartridge (45 μm, 3 ml/500 mg, CHROMABOND®, Norcross, USA). Samples were subjected to a polar silica cartridge Supelcosil LC-Si 5 μm, 15.0 cm × 4.6 mm (Supelco, Bellefonte, USA) for resolving vitamin D₃ and its metabolites in relevance to their polarity. Extracts were purified from sugars by connecting 2 amino columns (Supelcosil, 5 μm, 15.0 cm × 4.6 mm, Supelco®, Bellefonte, USA) in series for better separation.

2.3.4. Quantification of vitamin D₃ and 25-hydroxyvitamin D₃

Elution was performed as the following: 12 mL of 0.4% (Dichloromethane/2-propanol) solution were added to 40 μm from the extracts of the SPE columns. Samples were evaporated under a stream of nitrogen gas until dry. The mixture was reconstituted with 350 μm of 0.4% (Dichloromethane/Isopropyl Alcohol) solution. Exactly 100 μL was injected at a flow rate of 1.0 mL/min in the device. 0.5% of (Isopropyl Alcohol/n-hexane) served as mobile phase.
Quantification of vitamin D₃ and 25OHD₃ was performed by injecting extracts on SPE column RP C₁₈ (Synergy hydro-RP 4.0 μm, 4.6 × 250 mm, Phenomenex Incorporation, USA). Vitamin D₃ and 25OHD₃ were detected on a compacted UV photo-diode array at 264 nm. The content of Vitamin D₃ was achieved from the relation among peak areas of both vitamin D₃ and vitamin D₂. An external standard calibration curve was used to calculate the content of 25OHD₃ in pork samples.

2.4. Determination of total fat

The determination of total fat in pork samples was conducted by the gravimetric method [3]. Four samples (100 g) of each raw cut with rather similar fat concentrations were prepared for the analysis by grinding them using a meat grinder (DEM-JR01, Xiaomi Mi, China) and then storing them in plastic packs at a temperature of −20 °C for 12 h.

Each sample was treated with 8 M HCL, gently mixed, and ethanol was added. The liberated fat was then extracted with a mixture of petroleum ether and diethyl ether solvents. The solvent was evaporated and the fat was weighed then the percentage of fat content was calculated.

Ethical Statement

There is no funding for the present effort. There is no conflict of interest. The data is available in public domain.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships which have, or could be perceived to have, influenced the work reported in this article.

Data Availability

Dataset on the content of vitamin D₃ and 25-hydroxyvitamin D₃ in 40 pork (Breitov breed) commodities (Original data) (figshare).

CRediT Author Statement

Ali J. Othman: Visualization, Methodology, Software, Formal analysis, Writing – original draft; Ludmila G. Eliseeva: Visualization, Formal analysis; Fatima M. Duksi: Formal analysis, Resources, Writing – original draft; Polina G. Molodkina: Methodology, Software, Formal analysis; Alyona D. Shalankina: Methodology, Software, Formal analysis.

Acknowledgment

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Supplementary Materials

Supplementary material associated with this article can be found in the online version at doi: 10.1016/j.dib.2022.108153.
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