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1 **Nutrient, fibre, sorbitol and chlorogenic acid content of prunes**
2 **(*Prunus domestica*): an updated analysis and comparison of**
3 **different countries of origin and database values**
4

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11

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14

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16

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24 **Abstract**

25 Current prune composition data is outdated and requires a comprehensive and comparative
26 re-analysis. This novel study aimed to: (i) analyse and compare prune composition from major
27 countries of origin; and (ii) provide a comprehensive compositional analysis of prunes of USA
28 origin and compare this with UK and USA database data. Prune samples were analysed for
29 major nutrients and bioactive compounds and compared between countries of origin. Total
30 fibre was higher in prunes from the USA (12.0 g/100g) and Chile (11.5 g/100g) compared with
31 France (8.4 g/100g) and Argentina (8.9 g/100g), while prunes from all countries contained
32 high levels of sorbitol (11.2-15.5 g/100g). Differences of energy and starch values compared
33 with national databases reflected different approaches to sampling and analysis. In
34 conclusion, prunes contain high levels of fibre and other bioactive compounds. Variations
35 between country of origin and database values highlight the importance of transparency in
36 documenting sampling and analysis methods.

37 **Introduction**

38 Studies have highlighted the potential benefits of dried fruits on a variety of health outcomes
39 (Chang et al. 2016). In particular their high fibre content has led to investigation of the role of
40 dried fruit in the maintenance and promotion of gastrointestinal health (Lever et al. 2015)
41 which is considered of major public health importance (DuBois 2004; Wald et al. 2007). The
42 impact of dietary fibre on health is affected by variations in its chemical composition (e.g.
43 distribution of different fibre fractions) and physical structure (e.g. degree of polymerisation,
44 molecular weight and linkages) that alter its solubility, viscosity and fermentability. Given that
45 dried fruits are nutritionally comparable to whole fresh fruits, only provided in a smaller and
46 more concentrated form, they may be a convenient and versatile option for increasing fruit
47 consumption across population groups (Sadler et al. 2019).

48

49 Plums are taxonomically diverse stone fruits of *Prunus domestica* L. and are commonly
50 consumed in their dried form, termed prunes. Data from various sources, including the United
51 Kingdom (Finglas 2015) and the United States of America (USA) (US Department of Agriculture
52 2018), indicate that prunes are naturally high in a variety of poorly-fermented and readily-
53 fermented dietary fibres (>6 g/100g including hemicellulose, pectin, cellulose). In addition,
54 prunes contain other bioactive compounds such as polyphenols, which may stimulate colonic
55 proliferation of microorganisms such as Bifidobacteria and Lactobacilli. Furthermore, prunes
56 contain high amounts of sorbitol (~12 g/100g) which is known to have laxative effects (Yao et
57 al. 2014). Indeed, a systematic review concluded that prunes may play a role in
58 gastrointestinal health by increasing stool frequency and improving stool consistency (Lever
59 et al. 2014).

60

61 Data on prune composition require updating for several reasons. Firstly, existing databases,
62 such as McCance and Widdowson (UK) and USDA (USA) databases, do not report a wide range
63 of components relevant to gut health (e.g. different fibre fractions and sorbitol content), and
64 secondly the current data were compiled between 1980 and 2001 and therefore may no
65 longer accurately reflect present-day prune composition. Thirdly, the USDA data calculates
66 total carbohydrate 'by difference', which does not account for the lower energy contributions
67 from unavailable carbohydrates. Fourthly, the composition of prunes may vary depending on

68 a variety of factors including growing and harvesting conditions and post-harvest processes
69 (e.g. drying, dehydration and rehydration, storage conditions). Given that the vast majority of
70 global supply of prunes originates from four countries: the USA (largely California, 43%), Chile
71 (24%), France (16%) and Argentina (15%) (Buncher 2012), currently-available prune
72 composition data may be confounded by variations in origin. For example, standard yellow
73 plums have been shown to contain higher vitamin and phenolic compound content than
74 organically grown plums (Lombardi-Boccia et al. 2004), while prunes from Australia have been
75 shown to contain higher iron and folate contents than prunes from USA and Chile (Bennett et
76 al. 2011). Finally, variations in the nutrient composition of prunes of different countries of
77 origin will impact the database values in each country. For example, databases in the USA
78 (USDA) and France (CIQUAL), both of whom are large producers of prunes, will reflect the
79 composition of prunes from those countries, whereas the database in the UK (McCance and
80 Widdowson), which does not grow large supplies of prunes, will reflect the composite of
81 prunes from different countries of origin.

82

83 With this in mind, we aimed to investigate the energy, macronutrient, micronutrient, fibre,
84 sorbitol and polyphenol composition of prunes by: (i) analysing and comparing the
85 composition of prunes from major countries of origin (USA, Chile, France and Argentina); and
86 (ii) undertaking an in-depth analysis of prunes of USA (Californian) origin and comparing this
87 with data from food composition databases.

88

89 **Materials and Methods**

90 ***Sample collection***

91 Prune samples grown by the four largest producers of prunes were collected in order that
92 composition could be both globally representative and compared between country of origin
93 (USA, Chile, France and Argentina). Prune samples were purchased from major population
94 centres in five countries across Europe (France, Germany, Italy, Spain, United Kingdom) as
95 these are five major European markets for prunes and thus data would reflect the
96 composition of prunes available across Europe, as well as meeting the Food Information to
97 Consumers Legislation (European Commission 2011). Prune samples were purchased as sold
98 to the customer from major retail outlets including supermarkets, department stores and
99 health food stores and including a range of brands (where available) to ensure purchase of

100 prunes representative of those most frequently consumed, i.e. with the highest volume of
101 sales. Prune samples were purchased at the same time of year and within use-by-dates.
102 Samples were required to be in unopened packets of ≥ 100 g with a remaining shelf life of ≥ 6
103 months. Prunes were stored unopened until analysis to minimise drying, water absorption
104 and contamination. Prunes were purchased pitted (stone removed) or whole. If purchased
105 whole, stones were removed prior to compositional analysis.

106

107 In total, the goal was to purchase 10 to 12 samples from each of the four countries of origin,
108 with at least 3 samples from each sampling country. This number is recommended for nutrient
109 composition database data and based upon guidance from Greenfield and Southgate (2003),
110 though this depends on the variability of the nutrients being measured.

111

112 Prune samples from each country of origin were pooled prior to analysis. Funding restrictions
113 meant that the study could either: (i) individually analyse a number of prune samples from a
114 single country, thus allowing measurement of within-country variation but not between-
115 country variation; or (ii) analyse a pooled sample from a number of sampling countries, thus
116 allowing measurement of between-country variation albeit without statistical comparison.
117 Given the wide geographic difference in countries of origin (USA, France, Chile, Argentina), it
118 was felt that between-country variations, rather than within-country variations, were likely
119 to be larger and therefore of greater nutritional relevance.

120

121 ***Sample preparation and analysis***

122 Samples were pooled according to country of origin (**Table 1**). This pooled sample comprised
123 an equal weight of 500 g (i.e. 100 g adjusted weight from each sampling country), of prunes
124 from each of the five sampling countries. Pooled samples were homogenised using a hand
125 mincer, divided into aliquots, stored frozen at -80°C and defrosted prior to analysis.

126

127 Prune samples were analysed at Leatherhead Food Research, Surrey, UK. The pooled sample
128 from each of the four countries of origin was analysed using standard methods for energy
129 (calculated from macronutrient data), protein (total nitrogen), fat (Soxhlet), carbohydrate
130 (calculated by difference), sugars and sorbitol (ion-exchange chromatography), a range of
131 fibre classifications (AOAC methods, Englyst), and chlorogenic and neochlorogenic acid (ultra-

132 performance liquid chromatography tandem mass spectrometry, UPLC with MS-MS) (**Table**
133 **2**). In addition, further in-depth analyses were performed on the pooled sample of prunes
134 from the largest global producer (California, USA) including fatty acids (gas chromatography
135 with flame ionisation detection), sugars (ion-exchange chromatography) and major
136 micronutrients (inductively coupled plasma optical emission spectrometry ICP-OES, high
137 performance liquid chromatography HPLC) (**Table 2**).

138

139 In terms of the chromatographic methods, for sugar and sorbitol, extraction from the prune
140 samples was performed by sonication in hot water and treatment with Carrez reagents. The
141 filtered solution was then analysed using high-performance anion-exchange chromatography
142 coupled with pulsed electrochemical detection (HPAEC-PED) using a Dionex PA20 column
143 (Corradini et al, 2012). For chlorogenic and neochlorogenic acids, extraction from the prune
144 samples was performed in hot water and methanol and the solution analysed using UPLC with
145 MS-MS equipped with an ethylene bridged hybrid column (C18 2.1 x 50 mm, 1.7 µm). For
146 fatty acids, transmethylation was undertaken to form methyl esters which were analysed
147 using gas-liquid chromatography with a flame ionisation detection (Seppänen-Laakso, et al,
148 2002). For vitamin B analysis, extraction was performed using HCl and the solution analysed
149 using HPLC with fluorescence detection using a C18 conventional column (250 x 4.6 mm, 5
150 µm).

151

152 Duplicate analyses were carried out for analytes that were not routinely measured at the
153 research centre. However, routine analyses were not performed in duplicate as these had
154 criteria defining the limits of repeatability.

155

156 **Results**

157 ***Sample purchases***

158 Sample purchases were made in France (Normandy), Germany (Bonn), Italy (Milan, Novara),
159 Spain (Madrid), and the UK (London) between March and June 2013. The pack sizes of the
160 purchased prune samples varied between 120 g and 1000 g. **Table 1** shows the number of
161 prune samples purchased and analysed from each sampling country and by country of origin.
162 One sample was excluded as it exceeded the use-by-date by the time of analysis and four

163 samples were excluded because the country of origin was unclear. Eighteen different samples
164 were pooled and analysed for USA and French prunes, fifteen for Chilean prunes, but only five
165 for Argentinian prunes (all purchased from Spain) due to their lack of availability in Europe at
166 that time. The amount analysed from each individual sample was weighted so that an equal
167 amount from each sampling country was included and pooled to make up a total of 500g from
168 each country of origin (**Table 1**).

169

170 ***Composition Data***

171 The composition of prunes from the pooled samples originating from USA, Chile, France and
172 Argentina are shown in **Table 2**. In general there were few major differences in nutrients and
173 fibre fractions between prunes of different countries of origin.

174

175 Differences in starch content were observed between countries, being lower in prunes of
176 French origin (1.9 g/100 g) compared with others (5.7-6.6 g/100g). Total fibre (measured
177 using AOAC 2011.25) was higher in prunes from the USA (12.0g/100g) and Chile (11.5g/100g)
178 compared with those from France (8.4g/100g) and Argentina (8.9g/100g).

179

180 Prunes contained high levels of sorbitol (11.2-15.5g/100g) with broadly similar values across
181 the countries of origin. High levels of the phenolic compounds chlorogenic acid and
182 neochlorogenic acid were also found in prunes, however, in general these were higher in
183 prunes from the USA (3.6 and 89.3 g/100g) and France (3.9 and 92.0 g/100g) compared with
184 prunes from Chile (1.3 and 39.8 g/100g) and Argentina (1.3 and 40.3 g/100g) (**Table 2**).

185

186 The composition of prunes from the USA pooled sample compared with data from the USDA
187 nutrient database and McCance and Widdowson's the composition of foods is shown in **Table**
188 **3**. Concentrations per wet weight are presented in order to be consistent with these
189 databases. Energy and starch values (230 kcals/100g and 6.6g/100g, respectively) were closer
190 to values published by the USDA database (240 kcals/100g and 5.1 g/100g, respectively), than
191 McCance and Widdowson (141 kcals/100g and 0.0 g/100g, respectively).

192

193 **Discussion**

194 The current study aimed to investigate the energy, macronutrient, micronutrient, fibre,
195 sorbitol and polyphenol composition of prunes by: (i) analysing and comparing the
196 composition of prunes from major countries of origin (USA, Chile, France and Argentina); and
197 (ii) undertaking an in-depth analysis of prunes of USA (Californian) origin and comparing this
198 with data from food composition databases.

199

200 In regards to the measured composition of prunes from different countries of origin, while
201 the pooling of samples precluded statistical comparisons, at face value there were few
202 differences in energy and macronutrient content between them, apart from starch which was
203 lower in prunes of French origin (**Table 2**). Given that the same methods of analysis were used
204 for prunes of all countries of origin and analysis occurred at the same time and in the same
205 run, these differences likely reflect true compositional differences in prune samples between
206 countries.

207

208 There were no major differences in dietary fibre content when measured using the AOAC
209 991.43 method (which excludes low molecular weight fibres and most types of resistant
210 starch) nor using the Englyst method (non-starch polysaccharides). However, when measured
211 using the AOAC 2011.25 method, fibre was higher in prunes from USA and Chile compared
212 with France and Argentina. The AOAC 2011.25 method includes all categories of dietary fibre,
213 high and low molecular weight fibres and all types of resistant starch. Taken together, this
214 suggests that US and Chilean prunes likely contain greater low molecular weight fibres and
215 resistant starch than French and Argentinian prunes. Low molecular weight fibres are soluble,
216 explaining the higher soluble fibre content in USA (7.6 g/100 g) and Chilean (6.3 g/100 g)
217 prunes compared with others (4.4-4.6 g/100 g). In addition, French prunes contained less
218 sorbitol, while Chilean and Argentinian prunes had lower chlorogenic and neochlorogenic acid
219 content than the prunes of other origins. As previously mentioned, these differences may be
220 due to variations in soil management, plum ripeness or storage conditions (Donen 1939; Piga
221 et al. 2003), although the reasons for any differences was not investigated here.

222

223 In regards to prunes of USA (Californian) origin (**Table 3**), there were minor differences
224 between the current analytical data and those published by USDA, though these were small
225 and likely negligible from a nutritional perspective. Given that the USDA database is updated
226 regularly through submission of independent analyses from food manufacturers, the minor
227 differences observed may simply reflect seasonal variation in composition. However, there
228 were larger differences in both the current analytical data and the USDA data compared with
229 the UK data provided by McCance and Widdowson, the latter reporting lower energy and
230 starch values. Notably, little information is provided on the sourcing of prune samples
231 reported in McCance and Widdowson and so it is unknown whether prune origin could be
232 responsible for differences in starch content. Water content was comparable between the
233 data (30.9-31.1%), therefore any differences were not due to variation in water content.
234 Rather, the difference in energy content is explained by differences in the components
235 included in the energy calculation and different conversion factors used.

236

237 In the current study, energy content is calculated based upon the contribution of 'available
238 carbohydrate', fat, protein, fibre and polyols, as per European Union labelling regulations (EC,
239 2011). The USDA data includes 'total carbohydrate' in the energy calculation (rather than
240 'available carbohydrate'), and therefore does not take into account the lower energy
241 contribution from fibre and polyols, and this is reflected in the slightly higher energy value
242 published by USDA (240 kcal/100 g) compared with the current analytical data (230 kcal/100
243 g). In stark contrast, the UK data from McCance and Widdowson (141 kcal/100 g) excludes
244 fibre and polyols from the energy calculation.

245

246 Prunes contained high levels of sorbitol (11.2-15.5 g/100g), these values being similar to USDA
247 values (12.0 g/100g) and other studies in the scientific literature (10.8 g/100g) (Yao et al.
248 2014). The sorbitol content of prunes is therefore higher than that of its non-dried
249 counterpart plums (2.4 g/100g), as well as other non-dried stone fruits such as cherries (0.7
250 g/100g) and dried fruits such as dried apricots (6g/100g), dried pear (8.1 g/100g) and dried
251 apple (1.9g/100g) (Yao et al. 2014). Some polyols have been shown to induce increases in
252 small intestinal water, although this has not been confirmed for sorbitol. For example, a
253 fourfold increase in small intestinal water was observed in healthy individuals 60 minutes
254 following ingestion of 17.5 g of mannitol (Marciani et al. 2010).

255

256 Prunes also contained high levels of chlorogenic acid (1.3-3.9 g/100g) and neochlorogenic acid
257 (39.8-92.0 g/100g), particularly those from the USA and France. This reflects data from
258 previous studies reporting high levels of phenolic compounds in prunes (Donovan et al. 1998;
259 Stacewicz-Sapuntzakis 2013). These phenolic compounds are partially absorbed in the small
260 intestine and the remainder enter the colon where they undergo biotransformation by the
261 microbiota into caffeic acid and quinic acid (Olthof et al. 2001). A recent systematic review
262 suggests that polyphenols and their degradation products can modulate the gut microbiota
263 and have prebiotic effects (Nash et al. 2018). Chlorogenic acid has been shown to inhibit the
264 growth and adhesion of selected gut pathogens to a human gut cell line and to enhance the
265 proliferation and adhesion of the probiotic *L. rhamnosus* (Parkar et al. 2008). Taken together,
266 it is plausible that the combination of different dietary fibres, sorbitol and polyphenols
267 naturally abundant in prunes create a synergistic effect, which in part, may be the reason why
268 prunes are considered beneficial for gastrointestinal health (European Food Safety Authority
269 2014).

270

271 The current analytical data and the USDA data calculate carbohydrate values by difference
272 (subtracting amounts of the other proximates from the total weight), while McCance and
273 Widdowson calculate available carbohydrate using monosaccharide equivalents of each
274 measured component. In the McCance and Widdowson UK data, available carbohydrate is
275 equal to total sugars since no polyols, oligosaccharides or starch are reported. Though the
276 reason for the lack of starch in prunes (0.0 g/100 g) reported in the McCance and Widdowson
277 UK data is unclear, it is possible that when analysis was undertaken, prunes of French origin
278 (which in the current analysis contained less starch) were more readily available and
279 accessible. Notably, the current analytical data and the data from the USDA database may
280 considerably overestimate the available carbohydrate content by including unmeasured
281 components which are not absorbed or not metabolised in the body to produce energy (e.g.
282 sorbitol). In the present analytical data the sum of starch and sugars is 12 g/100g less than
283 the value for available carbohydrate by difference, while in the USDA data the sum of starch
284 and sugars is around 20 g/100g less than the value for total carbohydrate by difference that
285 has been used to calculate energy content. True energy values (kcal) for prunes appear to be
286 between 230-240 kcal/100g in accordance with the present analytical data (230 kcal/100g)

287 and the USDA database (240 kcals/100g). This is in contrast to McCance and Widdowson that
288 presents noticeably lower energy values (141 kcals/100g).

289

290 **Limitations and strengths**

291 The major limitation of this study was that, due to financial constraints, we did not analyse
292 multiple prune samples from each country of origin that would have enabled both within-
293 country variation and between-country statistical comparisons to be performed. In contrast,
294 our approach enabled only between-country variation to be analysed, albeit not statistically
295 compared. However, this approach allowed for a wide range of important nutrients and other
296 compounds relevant to health to be included, which we felt outweighed the limitations of
297 pooling samples. Despite the limitation of pooling prune samples from each country of origin,
298 a robust sampling methodology was adopted based upon standards used for food
299 composition databases to ensure high levels of representativeness in each pooled sample,
300 including sourcing from a range of major retail centres in numerous sampling countries.

301

302 Further limitations include the small number of samples from Argentina, which may therefore
303 not be fully representative of Argentinian prunes available across Europe. Any differences
304 attributable to country of origin can only be ascertained by controlling other factors that can
305 influence variation in nutrient composition. The sampling protocol attempted to account for
306 seasonal variation and storage conditions by purchasing samples at the same time of year and
307 within use by dates, and minimised changes in composition between purchase and analysis.
308 However, given that all prunes were sampled at point of sale, pre-purchase confounding
309 variables such as exposure to heat, light and humidity could not be controlled for. This might
310 be relevant if these factors influence nutrient composition as some previous data suggests,
311 however, although such analyses are of important academic and commercial interest, from a
312 practical perspective the consumer cannot currently impact post-harvest/pre-purchasing
313 processing.

314

315 **Conclusion**

316 The current study provides evidence that small differences in dietary fibre, sorbitol and
317 phenolic content may exist between prunes of different countries of origin. To our knowledge,
318 this is the first study to provide a comprehensive and comparable compositional analysis of

319 prunes of USA (Californian) origin, updating the currently available data reported in the USDA
320 and McCance and Widdowson UK databases. This allows for a more accurate measurement
321 of nutrient intake for future dietary intervention studies. The current study has highlighted
322 the need for thorough and transparent documentation of sampling methods used to produce
323 data for national databases. Furthermore, to eliminate artificial differences in energy content
324 between different databases, carbohydrate values should be expressed using the same
325 method and energy should be calculated using the same conversion factors.

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400

Table 1: Number of prune samples purchased, pooled and analysed, by sampling country and country of origin.

Sampling country	USA (California)			France			Chile			Argentina		
	Number of samples		Weight contributing to analysis	Number of samples		Weight contributing to analysis	Number of samples		Weight contributing to analysis	Number of samples		Weight contributing to analysis
	Purchased	Analysed		Purchased	Analysed		Purchased	Analysed		Purchased	Analysed	
Germany	4	4	125 g (31.25 g per sample)	3	3	125 g (41.6 g per sample)	4	4	125 g (31.25 g per sample)	0	0	-
Italy	5	5	125 g (25 g per sample)	2	2	125 g (62.5 g per sample)	2	2	125 g (62.5 g per sample)	0	0	-
UK	5	5	125 g (25 g per sample)	5	5	125 g (25 g per sample)	5	5	125 g (25 g per sample)	0	0	-
France	0	0	-	16	8**	125 g (15.625 g per sample)	0	0	-	0	0	-
Spain	5	4*	125 g (31.25 g per sample)	4	0***	-	4	4	125 g (31.25 g per sample)	5	5	500 g (100 g per sample)
Total	19	18	500 g	30	18	500 g	15	15	500 g	5	5	500 g

* One sample exceeded the best before date and was excluded

** Only 8 samples required

*** Samples all labelled Spanish/French origin and thus excluded

Table 2: Composition of prunes from the pooled samples from USA, Chile, France and Argentina, purchased in Europe

	Method of analysis	Country of origin (per 100 g wet weight)				Country of origin (per 100 g dry weight)			
		USA	Chile	France	Argentina	USA	Chile	France	Argentina
Moisture (g)	Oven drying	30.9	30.5	33.2	28.7	-	-	-	-
Ash (g)	Incineration (muffle furnace)	1.58	1.53	1.36	1.38	-	-	-	-
Energy (kcal)	Multiplying macronutrients by Atwater factors	230	235	228	241	333	337	340	338
Protein (g)	Total N (Dumas, TruSpec analyser) x 6.25	2.5	2.1	1.6	2.0	3.6	2.9	2.4	2.8
Fat (g)	Soxhlet method	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total carbohydrate (g)	Calculated 'by difference'	65.1	65.9	63.9	68.0	94.1	94.9	95.4	95.3
Available carbohydrate (g)	Calculated 'by difference'	56.9	58.2	55.6	59.9	82.2	83.8	83.0	84.0
Starch (g)	Enzymatic hydrolysis (Megazyme)	6.6	5.7	1.9	6.1	9.5	8.1	2.8	8.5
Total sugars (g)	Ion-exchange chromatography	38.2	41.3	40.7	42.2	55.2	59.4	60.7	59.1
Fructose	Ion-exchange chromatography	14.0	16.2	16.0	16.9	20.2	23.3	23.9	23.6
Glucose	Ion-exchange chromatography	24.2	25.1	24.6	25.3	35.0	36.1	36.8	35.5
Galactose	Ion-exchange chromatography	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Lactose	Ion-exchange chromatography	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Maltose	Ion-exchange chromatography	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sucrose	Ion-exchange chromatography	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sugar alcohols (g)									
Sorbitol	Ion-exchange chromatography	14.8	13.8	11.2	15.5	21.4	19.9	16.7	21.7
Dietary Fibre (g)									
Total fibre	Enzymatic-gravimetric (AOAC 991.43)	8.2	7.7	8.3	8.1	11.9	11.1	12.4	11.4
Total fibre	Enzymatic-gravimetric (AOAC 2011.25)	12.0	11.5	8.4	8.9	17.4	16.5	12.5	12.5
Insoluble fibre	Enzymatic-gravimetric (AOAC 2011.25)	4.5	5.7	4.0	4.3	6.5	8.1	6.0	6.0
Soluble fibre	Enzymatic-gravimetric (AOAC 2011.25)	7.6	6.3	4.4	4.6	11.0	9.1	6.5	6.4
Total NSP	Englyst et al (1994)	6.2	5.8	5.8	5.9	9.0	8.3	8.7	8.3
Insoluble NSP	Englyst et al (1994)	2.0	1.8	2.0	1.6	2.9	2.6	3.0	2.2
Soluble NSP	Englyst et al (1994)	4.3	4.1	3.9	4.3	6.1	5.8	5.7	6.0
Cellulose	Englyst et al (1994)	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4

	Method of analysis	Country of origin (per 100 g wet weight)				Country of origin (per 100 g dry weight)			
		USA	Chile	France	Argentina	USA	Chile	France	Argentina
Lignin	Enzymatic-gravimetric (AOAC 994.13)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fructans	Enzymatic spectrophotometric (AOAC 999.03)	0.3	0.2	0.3	0.3	0.4	0.3	0.5	0.4
Phenolic compounds (mg)									
Chlorogenic acid	UPLC with MS-MS	3.6	1.3	3.9	1.3	5.2	1.9	5.8	1.8
Neochlorogenic acid	UPLC with MS-MS	89.3	39.8	92.0	40.3	129.1	57.2	137.3	56.4

UPLC with MS-MS: Ultra-performance liquid-chromatography tandem mass spectrometry

Table 3: Composition of prunes originating from the USA (California), as analysed in the current study, compared with data from the USDA nutrient database and McCance and Widdowson's The Composition of Foods. Values are units per 100 g wet weight.

	Analysis in the current study		Database values	
	Method of analysis in the current study	USA (Californian) (wet weight per 100 g)	USDA (wet weight per 100 g)	McCance & Widdowson (wet weight per 100 g)
Water (g)	Oven drying	30.9	30.9	31.1
Ash (g)	Incineration (muffle furnace)	1.58	NR	2.64
Energy (kcal)	Multiplying macronutrients by Atwater factors	230	240	141
Protein (g)	Total N content (Dumas, TruSpec analyser) x 6.25	2.5	2.2	2.5
Fat (g)	Soxhlet method	<0.2	0.4	0.4
Fatty acids (g)				
Saturated Fatty Acids	Gas chromatography with flame ionisation detection	<0.1	<0.1	NR
Mono-unsaturated Fatty Acids	Gas chromatography with flame ionisation detection	<0.1	<0.1	NR
Polyunsaturated Fatty Acids	Gas chromatography with flame ionisation detection	<0.1	<0.1	NR
Trans-unsaturated Fatty Acids	Gas chromatography with flame ionisation detection	<0.1	NR	NR
Total carbohydrate (g)	Calculated 'by difference'	65.1	63.9	NR
Available carbohydrate (g)	Calculated 'by difference'	56.9	NR	34.0
Starch (g)	Enzymatic hydrolysis (Megazyme)	6.6	5.1	0.0
Total sugars (g)	Ion-exchange chromatography, HPAEC-PED	38.2	38.1	34.0
Fructose	Ion-exchange chromatography, HPAEC-PED	14.0	12.5	12.1
Glucose	Ion-exchange chromatography, HPAEC-PED	24.2	25.5	17.9
Galactose	Ion-exchange chromatography, HPAEC-PED	<0.01	0.0	NR
Lactose	Ion-exchange chromatography, HPAEC-PED	<0.01	0.0	0.0
Maltose	Ion-exchange chromatography, HPAEC-PED	<0.01	0.1	0.0
Sucrose	Ion-exchange chromatography, HPAEC-PED	<0.01	0.2	4.1

	Analysis in the current study		Database values	
	Method of analysis in the current study	USA (Californian) (wet weight per 100 g)	USDA (wet weight per 100 g)	McCance & Widdowson (wet weight per 100 g)
Sugar alcohols (g)				
Sorbitol	Ion-exchange chromatography, HPAEC-PED	14.8	NR	NR
Dietary Fibre (g)				
Total dietary Fibre	AOAC 991.43	8.2	7.1	NR
Total dietary Fibre	AOAC 2011.26	12.0	NR	NR
Insoluble dietary fibre	AOAC 2011.26	4.5	NR	NR
Soluble dietary fibre	AOAC 2011.26	7.6	NR	NR
Non-starch polysaccharides	Englyst et al (1994)	6.2	NR	5.7
Insoluble NSP	Englyst et al (1994)	2.0	NR	NR
Soluble NSP	Englyst et al (1994)	4.3	NR	NR
Cellulose	Englyst et al (1994)	0.2	NR	NR
Lignin	Enzymatic-gravimetric method (AOAC 994.13)	0.009	NR	NR
Fructans	Enzymatic spectrophotometric (AOAC 999.03)	0.3	NR	NR
Phenolic compounds (mg)				
Chlorogenic acid	UPLC with MS-MS	3.6	NR	NR
Neochlorogenic acid	UPLC with MS-MS	89.3	NR	NR
Minerals				
Calcium (mg)	ICP-OES	45.0	43.0	34.0
Iron (mg)	ICP-OES	0.7	0.9	2.6
Potassium (mg)	ICP-OES	622	732	760
Magnesium (mg)	ICP-OES	47.0	41.0	24.0
Sodium (mg)	ICP-OES	9.8	2.0	11.0

Analysis in the current study		Database values		
	Method of analysis in the current study	USA (Californian) (wet weight per 100 g)	USDA (wet weight per 100 g)	McCance & Widdowson (wet weight per 100 g)
Phosphorus (mg)	ICP-OES	68.1	69.0	73.0
Zinc (mg)	ICP-OES	0.4	0.4	0.4
Iodine (mg)	ICP-OES	3.0	NR	NR
Selenium (µg)	ICP-OES	30.0	0.3	3.0
Vitamins				
Riboflavin (mg)	HPLC	0.0	0.2	0.2
Niacin (mg)	HPLC	1.1	1.9	1.3
Vitamin B6 (mg)	HPLC	0.3	0.2	0.2
Biotin (µg)	Plasmon resonance technology	20.0	NR	Tr

NR = Not reported

Tr = trace

ICP-OES Inductively Coupled Plasma Optical Emission Spectrometry

HPAEC-PED High-Performance Anion-Exchange Chromatography Coupled with Pulsed Electrochemical Detection

HPLC High Performance Liquid Chromatography