Analysis and evaluation on nutritive components of *Pollicipes mitella*

CHEN Ning, LIN Gang, RAO Xiao-zhen, ZHANG Dian-cai

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**Abstract**: The nutritive components of *Pollicipes mitella* were determined, and its nutritional quality was also evaluated systematically. The crude protein, crude fat, ash, moisture, and Nitrogen Free Extract (NFE) of the fresh muscle were 19.28%, 2.54%, 1.47%, 74.47%, and 2.24%, respectively. On the basis of fresh matter of the muscle, the amount to hydrolytic amino acids was 18.08%, in which the content of essential amino acids was 6.77%, and the amount of total delicious amino acids was 17.83%. The fatty acids contained 74.47% high unsaturated fatty acids (HUFA), in which the content of EPA and DHA were 13.37% and 20.67%, respectively. The muscle of *Pollicipes mitella* has very high nutritive and care value. In conclusion, the muscle of *Pollicipes mitella* has very high nutritive and care value.

**Key words**: *Pollicipes mitella*; nutritive components; nutritive evaluation

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**Key words**: *Pollicipes mitella*; nutritive components; nutritive evaluation
1.2

(GB/T5009.3–85; GB/T5009.4–85; GB/T5009.5–85; GB/T5009.6–85; GB/T14965.94) JY/T019–1996

1.3

FAO/WHO1973

FAO/WHO

EAAI

AAS

CS

EAAI=n√\frac{100A_1}{A_E}×\frac{100B_1}{B_E}×\frac{100C_1}{C_E}×…×\frac{100I_1}{I_E}

\text{AAS} = \frac{a_n}{A_1(\text{FAO/WHO})}

\text{CS} = \frac{a_n}{A_1(\text{Egg})}

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74.47% 

19.28% (17.6% 

2.54% 

1.97% 

2.24% 

1.47% 

1.75% 

20.00% 

74.47±1.41 19.28±0.28 2.54±0.12 1.47±0.02 2.24±0.71

74.47% ± 1.53%

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龟足肌肉含有的常量及微量元素（表4）。

### 表4 龟足肌肉中的一些矿物质含量与其他几种食物的比较

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### 2.4 脂肪酸的含量

龟足肌肉中主要包含19种脂肪酸，其中饱和脂肪酸（SFA）8种，单不饱和脂肪酸（MUFA）4种，多不饱和脂肪酸（PUFA）7种（表3）。

脂肪酸中的棕榈酸含量最高，占总脂肪酸的25.13%；木焦油酸含量最低，占0.27%。

下表是脂肪酸的含量。

### 表3 龟足肌肉中脂肪酸的组成和含量

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3.1

龟足柄部肌肉的一般营养成分与其它几种食物的比较见表1，从表中可知其蛋白质含量高于鸡蛋、鲤鱼、对虾、梭子蟹和牡蛎，脂肪含量高于对虾和牡蛎，低于鲤鱼、梭子蟹和鸡蛋，灰分含量高于鲤鱼、对虾和鸡蛋，低于梭子蟹和牡蛎，无氮浸出物含量高于鲤鱼、梭子蟹和鸡蛋，低于对虾和牡蛎。结果表明龟足肌肉是一种蛋白质含量高、脂肪含量低、富含矿物质的优质食物。

3.2

对龟足柄部肌肉进行了17种氨基酸含量检测（色氨酸未进行检测）。含量最高的是谷氨酸，其次精氨酸，谷氨酸不仅使肌肉味道鲜美，还是脑组织生化代谢中的重要氨基酸，参与多种生理活性物质的合成[8]。Seifter[9]研究表明，精氨酸是创伤后的必需氨基酸，创伤后增加精氨酸的摄入量可降低氮的损失，从而促进创伤的愈合。因此龟足有较好的保健功能。

对膳食营养的评价一般最关注的是必需氨基酸的含量和比例。将龟足必需氨基酸占鲜重的含量与其他几种常见的食物进行比较（表5），可知龟足的必需氨基酸总量比其他5种常见食物都高。龟足肌肉除赖氨酸的含量低于鲤鱼、蛋+胱氨酸略低于对虾外，其他必需氨基酸含量均高于另外几种食物。可见龟足鲜肉中的必需氨基酸含量非常丰富。

表5 龟足肌肉必需氨基酸含量与其他几种食品的比较

<table>
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<th>异亮氨酸</th>
<th>亮氨酸</th>
<th>赖氨酸</th>
<th>苏氨酸</th>
<th>缬氨酸</th>
<th>蛋+胱氨酸</th>
<th>苯丙+酪氨酸</th>
<th>必需氨基酸总量</th>
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<tr>
<td>龟足</td>
<td>800</td>
<td>745</td>
<td>757</td>
<td>614</td>
<td>222</td>
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<td>710</td>
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<tr>
<td>鲤鱼</td>
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<td>1 076</td>
<td>357</td>
<td>1 030</td>
<td>681</td>
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<td>对虾</td>
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<td>366</td>
<td>837</td>
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<td>梭子蟹</td>
<td>870</td>
<td>693</td>
<td>732</td>
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<td>225</td>
<td>568</td>
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<td>75.49</td>
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<tr>
<td>牡蛎</td>
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<td>841</td>
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表6 龟足肌肉必需氨基酸的评价

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龟足含有丰富的人体正常生长发育所必需的和起保健作用的矿物质，尤其是 Mg、Ca、Fe、Zn 和 Se 的含量十分丰富。结果表明龟足除了 Ca 含量低于牡蛎和梭子蟹，Fe 含量低于牡蛎外，其 Mg、Ca、Fe、Zn 和 Se 都高于另外几种的含量（表 4）。

Mg 在许多必需的酶反应中作为辅助离子，参与遗传信息的传递和表达，在神经肌肉的传导和活动中起重要作用；Ca 是构成骨骼和牙齿的核心部分，具有维持神经与肌肉活动等作用；Fe 参与二氧化碳和氧的转运、交换，对呼吸和能量代谢有重要作用等；Zn 能调节细胞分化和基因表达，作为酶的组成部分，促进食欲，影响人的认知能力和创口的愈合等作用；Se 具有抗氧化、促进生长、保护视觉器官和心血管、抗肿瘤、解毒等作用。

值得注意的是龟足的硒含量异常丰富，是目前所有已知天然食物中含量最高的，因此龟足是很好的补硒食品。由于硒的中毒剂量只有适宜摄入量的 10 倍左右，根据中国居民膳食营养素参考摄入量之推荐摄入量（RNIs）和可耐受摄入量（ULs），儿童每天摄入量不超过 15 毫克。

### 脂肪酸营养价值分析

脂肪酸中以 PUFA 的生理功能最为重要，PUFA 对于稳定细胞膜功能、调控基因表达、维持细胞因子和脂蛋白平衡、抗心血管疾病以及促进生长发育等方面起着重要作用。将龟足的 PUFA 与其他几种食物比较（表 8），可知其 PUFA 总量比其他 5 种食物都高。PUFA 中以 ω-3 系列包括 EPA 与 DHA 最为重要，它们具有抗氧化、抗衰老、健脑补脑，提高记忆力及思维能力等的作用，人体不能合成它们，必需从食物中摄取。

龟足的 DHA+EPA 总量远高于其他 5 种食物的含量（表 8），说明龟足是一种优质的保健食品。

### 鲜味氨基酸总量

龟足的鲜味氨基酸总量低于对虾，高于鲤鱼、牡蛎、梭子蟹和鸡蛋。表明龟足不仅营养价值高，而且味道也较鲜美。

### 蛋白质氨基酸组成

龟足中必需氨基酸含量与 WHO/FAO 模式比较：异亮氨酸、亮氨酸、赖氨酸、苏氨酸、缬氨酸、蛋氨酸、苯丙氨酸、酪氨酸分别达到或超过 WHO/FAO 模式的 80%。

### PUFA 成分

龟足中 PUFA 成分含量与 WHO/FAO 模式比较：C20:4（AA）、C20:5（EPA）、C22:4、DHA、EPA 达到或超过 WHO/FAO 模式的 80%。

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注：表中其他数据引自文献 [7]。
入龟足肌肉以20g左右为宜，不宜超过135g。

成人每天摄入28g左右为宜，不宜超过225g。

4 结论

龟足蛋白质含量丰富，占鲜重的19.28%，占干重75.5%；氨基酸种类齐全，必需氨基酸含量丰富，比例均衡。鲜味氨基酸含量丰富，因此味道鲜美。

脂肪含量虽然较低，但不饱和脂肪酸含量较高，达58.2%，尤其是EPA和DHA含量高达34.3%。

龟足富含各种矿质元素，其中Mg、Ca、Fe、Zn和Se的含量高于许多其他食物。因此龟足是一种营养价值高、滋味鲜美、具有保健作用的优质食品，具有很大的开发利用价值和广阔的市场前景。

参考文献