

ヌクレオシド-5' -リン酸が豚肉からの筋原線維タンパク質の抽出とその加熱ゲル形成に及ぼす影響

(Effects of nucleoside-5'-monophosphate on the extraction of myofibrillar proteins from porcine meat and the formation of heat-induced gels from those proteins)

学位論文の内容の要旨

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ソーセージ製造に必須な筋原線維タンパク質(Mf-p)は、製造工程で食肉から抽出され、加熱するとゲルを形成する。この製造に使用されるピロリン酸塩は、アクトミオシン(AM)をアクチンとミオシンに解離して、これらMf-pの抽出を容易にしてゲル形成を助けている。他方、AMPとIMPといったヌクレオシド-5'-ーリン酸(NMP)がAMを解離することが示されている。本研究は、NMPがMf-p抽出とその加熱ゲル形成に及ぼす影響を明らかにすることを目的とした。

塩基が異なるNMPのAM解離作用を調べ、GMPを含めたプリンヌクレオシド-5'-ーリン酸(PrMP)がAMを解離することが明らかになった。

IMPまたはGMPを含む塩漬条件の0.3-0.5 M NaCl溶液によるMf-p抽出では、AMを解離するPrMPがMf-p抽出を高めることが明らかになった。IMPによる抽出は時間を要し、NaCl濃度上昇で高められたが、ピロリン酸四カリウム(KPP)による抽出は時間を要さず、NaCl濃度上昇でそれ以上高まらなかった。したがって、PrMPとKPPのMf-p抽出様式は異なることが明らかになった。さらに、PrMPとKPPの併用はMf-p抽出を著しく高めた。

生理的条件の0.2 M KCl下でIMPはKPPと同様に短時間でAMを解離させた。したがって、0.3-0.5 M NaCl下でのIMPによるMf-p抽出に時間を要した原因は、AMの解離そのものにはないと考えられた。他方、0.2 M KCl下では、IMPは筋原線維からMf-pを抽出しなかったが、KPPは抽出した。これらの結果から、AMを解離するIMPは細いフィラメント-Z線や太いフィラメント-コネクチン-Z線の結合を解除できないが、KPPはAMを解離するばかりでなくこれらの結合をも解除できると推定した。

IMPを添加した加熱ゲルを作製した結果、IMPが加熱ゲルの保水性、物性および官能特性を高めることが明らかになった。IMP添加ゲルのこれら性質は、KPP添加加熱ゲルに匹敵した。この主原因は、IMPによるMf-p抽出の増加によるものと推定した。

以上の知見は、PrMPを用いた高品質なソーセージ製造につながるであろう。また、NMPのAM解離にプリン骨格が必要なことと、PrMPとKPPのMf-p抽出様式の違いの発見はAMや筋原線維の構造の解明に資するであろう。

Effects of nucleoside-5'-monophosphate on the extraction of myofibrillar proteins from porcine meat and the formation of heat-induced gels from those proteins

Abstract of doctor thesis

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Myofibrillar proteins (Mf-ps) essential for productions of sausages are extracted from meat and then the gels of Mf-ps is formed when heated in the process for the production. Pyrophosphates enhance the extraction of Mf-ps by the dissociation of actomyosin (AM) to actin and myosin and contribute to the formation of heat-induced gels. It has been found that AM was dissociated by nucleoside-5'-monophosphates (NMPs) such as AMP and IMP. The objects of this study are to reveal effects of NMPs on the extraction of Mf-ps and the formation of heat-induced gels.

This dissociation mechanism of AM by NMPs containing different bases was examined. It was found that AM was dissociated by only prine-nucleoside-5'-monophosphates (PrMPs) such as GMP containing purine as bases.

In an extraction of Mf-ps by 0.3-0.5 MNaCl solutions, like the curing process, containing IMP or GMP, it was found that the extraction of Mf-ps was enhanced by PrMPs bearing an ability of the dissociation of actomyosin. The extraction by IMP was a time-consuming process and was enhanced by the rise of the NaCl concentration but that by tetrapotassiumpyrophosphates (KPP) was not so. Thus, it was found that PrMPs and KPP differ in an ability to extract Mf-ps. Furthermore, the extraction of Mf-ps was markedly enhanced by the combination of PrMPs and KPP.

Under the physiological condition of 0.2 M KCl, AM was dissociated by IMP in a short time similarly to KPP. Thus, the dissociation of actomyosin itself was unlikely to be responsible for the time-consuming extraction of Mf-ps by IMP at 0.3-0.5 MNaCl. At 0.2 M KCl, IMP was not able to extract Mf-ps from myofibrils but KPP was able to do. Based on these results, it was assumed that IMP cannot dissociate bindings between thin filaments and Z-lines or between thick filaments and connectin-Z-lines but KPP can dissociate those bindings.

Heat-induced gels containing IMP were prepared. It was found that the addition of IMP enhanced the water-holding capacity, physical and sensory properties of heat-induced gels. These features of IMP-added gels were comparable to those of KPP-added gels. This improvement of the features appears to be a result of the increase in the extraction of Mf-ps.

All these findings would enable the production of high-quality sausages using

PrMPs. The findings that PrMPs are necessary for the dissociation of AM and Mf-p extraction modes are different between PrMP and KPP appear to contribute to the clarification of the structures of AM and myofibrils.