〈教 育 報 告〉　　研究課程研究論文要旨

塩素錠剤の溶解特性と浄化槽流出水における消毒効果

Characteristics of chlorine tablet solubility and their disinfection efficiency of johkasou effluents

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家庭用の浄化槽では，その消毒は通常3～4ヶ月に一度の保守点検に補充される塩素錠剤の溶解に依存しているが，錠剤保持期間あるいは消毒効果は必ずしも十分ではない．このようなことから，浄化槽における消毒の実態を明らかにすることを目的として研究を進めた．

第1章では研究の背景と目的を述べ，第2章では生活排水の特性，浄化槽の概要，塩素消毒に関して文献調査を行った．本論には第3章から第6章を当て，第3章では塩素錠剤について，溶解の基本特性ならびに消毒槽実基を用いた溶解特性を扱い，第4章では塩素消費上および消毒効果上問題となるアンモニアとの反応を検討し，第5章では塩素耐性の異なる*E. coli*，*Candida albicans*，*Bacillus subtilis*の芽胞について不活化特性を把握した．また，6章では，これらの検討を総合するものとして，アンモニア，有機物質，浮遊物質からなる模擬処理水を用いて*E. coli*，*Candida albicans*に対する消毒効果を検討した．最後に，第7章でこれらの結果を総括するとともに，有機錠剤と無機錠剤の併用の可能性，薬剤塔の設置の工夫の可能性等を提言した．

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The night soil system in Japan is classified into three categories: public sewerage system, johkasou system (on site human wastwater treatment tank), and cesspit collective night soil treatment system. In johkasou, the biologically treated wastewater is usually disinfected by chlorination. Organic and inorganic tablets are used for this purpose. The basic properties on the solubility of chlorine tablets and their disinfection effects are still not clear. Usually, a johkasou is inspected every 3 or 4 months and the tablets are replaced by inspectors. During this period, the tablets may be exhausted completely. For that reasons, there is a need to clarify solubility and disinfection efficiency characteristies of these tablets.

To achieve these purposes, two commercially available chlorine tablets: organic (composed of trichloro-isocyanic acid, commercial name Kurines) and inorganic (composed of calcium hypochlorite, commercial name Haykrone) were studied. Their solubility under different conditions as well as their disinfection effects were examined using a small-scale johkasou, 1/8 the size of a johkasou for 10 persons. In that model, the flow rates was simulate that of real johkasou by considering the retention time.

The solubility of chlorine tablets was examined in order to obtain data on the solubility of these tablets and the factors which affect solubility. The factors studied include flow rate, temperature, pH of the water, and homogeneity of the chlorine content of the tablets. These data were used for evaluating the solubility of tablets in a johkasou disinfection chamber for 5 persons in summer and winter. Two columns containing chlorine tablets were used to simu-

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late the conditions in an actual johkasou. A predetermined daily flow rate model was used and the chlorine concentration at each flow rate was measured.

The results showed that, the characteristics of organic tablets are different than that of inorganic tablets. While the organic tablets were only partially soluble in water the inorganic tablets were highly soluble. Organic tablets lower the pH of water while the inorganic tablets increases the pH. This means that at the same chorine concentration, the germicidal effect of the organic tablets will be higher than the inorganic tablets because the chlorine from the organic tablets will be in the form of hypochlorus ahid. The chlorine from the inorganic tablets, will be in the form of hypochlorites ions.

High temperature increased the solubility of both organic and inorganic tablets. However, the degree of increase in the organic tablets was greater than in the inorganic tablets. In the summer, the solubility of organic tablets increased about 50% composed to winter, while for inorganic tablets the solubility increased about 15%.

Acidic and alkaline mediums inereased the solubility of organic tablets, while acidic mediums only increased the solubility of inorganic tablets. Although the chlorine content in both the organic and inorganic tablets is homogenous, the inner layer of the tablet contains a higher concentration of chlorine than the outer layer.

The chlorine concentration of the effluent in johkasou, using organic tablets at a high flow rate (400 liter/hr) did not exceed 5.5 mg/l (winter) and 9.1 mg/l (summer). This ratio does not fulfill Japanese regulations which requires the concentration of effluent not to be less than 10 mg/l. With inorganic tablets, the concentration exceeds 10 mg/l even in the winter.

The relationship between the flow rate of influent and the chlorine concentration of efflucnt could be determined with organic tablets. With inorganic tablets, the relationship depends on the time passed since the tablets were used. The chlorine concentration decreases are time due to the diminishing of the size of tablet.

If the organic tablets have to be used, the number of columns must be increased to at least three. This will increase the chlorine concentration at a high flow rate of 50% to become about 8 mg/l.

To clarify the disinfection efficiency of chlorine tablets, four kinds of micro-organisms were used: *Escherichia coli, Bacillus* spore, poliovirus and *Candiida albicans*. These micro-organisms vary in their resistance. *E. coli* is the least resistant, followed by poliovirus, *Candida albicans*, and the *Bacillus* spore which is the most resistant. The cermicidal effects of chlorine tablets on these micro-organisms was examined in order to evaluate the disinfection effects of the tablets.

The microbiological effects of chlorine tablets was examined under variable chlorine concentrations, then under constant chlorine concentrations from the start of the experiment. At a last step, the effect of chloramine was examined.

The results show that *E. coli* was easily inactivated by both organic and inorganic tablets even with low chlorine concentration. However the inorganic tablets were more efficient due to high solubility. The study shows that the *Candida albicans* needs a longer contact time and higher chlorine concentrations than *E. coli* for inactivation. With organic tablets, the required time for decreasing the number of *Candida albicans* by 5 log was in the range of one to two minutes in a chlorine concentration of 5 to 15 mg/l. However, there was no difference between the effects of both tablets on the survival of *Candida albicans* at the same chlorine concentration.

Regarding *Bacillus* spors, a long contact time is required even with high chlorine concentration. The organic tablets were more efficient than the inorganic tablets for inactivation of *Bacillus* spores even at similar chlorine concentrations. For

instance, at a high chlorine concentration of 101 mg/*l*, the required time for a 5 log decrease of the spores was 40 and 70 minutes for the organic and inorganic tablets, respectively. This was mainly due to the difference in the pH of water. The pH was acidic with organic tablets at thet concentration and alkaline with inorganic tablets. In acidic medium, chlorine is in the form of hypochlorous acid which has a stronger germicidal effect than hypochlorite ions which are formed in alkaline medium.

The results also show that poliovirus is more resistant than *E. coli* and less resistant than *Candida albicans*. This indicates that, in the process of disinfection, if *Candida albicaus* be completely inactivated, this would mean that virus also will be inactivated. By using the chloramine, it was found that the effect of monochloramine and dichloramine is much weaker than the free chlorine. It was also showen that monocloramine is more effective than dichloramine, but the difference was limited.

The reaction of tablets with ammonia and organic compounds was examined at specific pH value in order to evaluate the difference between the reactions of both tablets with ammonia. This has importance in determining the ratio of chloramine which is formed because each of the three forms of chloramine has a particular significance in water and wastewater treatment. The effect of pH on the reaction was also examined with organic tablets. Reaction of chlorine with nitrogenous organic compounds was examined to investigate the effects of organic compounds on chlorine consumption.

The results show that the reaction of ammonium nitrogen with organic and inorganic varies according the concentrations of ammonium nitrogen and contact time. At low ammonium nitrogen concentration and short contact time, inorganic tablets are more efficient of micro biological disinfection where the free chlomine concentration was higher than for organic tablets. At high ammonium nitrogen concentrations however, the organic tables were more efficient. After a long contact time, total chlorine decreased very sharply with both organic and inorganic tablets at low ammonium nitrogen concentration. However, free chlorine was still higher with inorganic tablets than with organic. In high ammonium nitrogen concentrations free chlorine will be higher in organic tablets than inorganic tablets.

The pH affects the reaction of chlorine with ammonium nitrogen depending on the concentration of ammonium nitrogen. At high ammonium nitrogen concentrations, and at neutral pH, the reaction was stable and monochloramine was the predominant chloramine. With increasing the acidity of the water, dichloramine was increased. At low ammonium nitrogen concentrations and neutral pH, free chlorine predominanted and total chlorine sharply decreased. These conditions are important in estimating the germicidal power of chlorine. Free chlorine was and to be the most efficient followed by monochloramine then dichloramine. The germicidal effect of monochloramine and dichloramine is 0.1 to 0.01 times as that of free chlorine.

The reaction of organic compounds with organic tablets was very fast and this will affect the disinfecting efficiency of chlorine because organic matter consume mosts of the chlorine in a short time.

When these results were applied to the real johkasou where the pH of water is usually neutral and the concentration of ammonia is high, it could be concluded that the chloramine which is formed will be mainly in the form of monochloramine. By considering the effect of chloramine and free chlorine on the micro-organisms, it is possible to calculate the germicidal effect of chloramine.

A small scale model of johkasou was used to apply all the results obtained from the solubility of tablets in johkasou, the reaction of ammonium nitrogen and organic compounds with the tablets as well as the disinfection efficiency of these tablets.

Flow rate was adjusted to simulate the flow rate in an actual johkasou for 10 persons. Chlorine concentration in the effluent was adjusted to be equal to that of an actual johkasou.

To examine the microbiological efficiency of the tablets, two micro-organisms were selected, *E. coli* and *Candida albicans.* These micro-organisms were selected depending on their resistance. The fate of both micro-organisms was examined under all conditions which closely simulated that of an actual johkasou. The efficiency of the tablets under the effects of organic matter, ammonia, and activated sludge was examined separately for both micro-organisms. Then, the effect of all three factors was examined together.

The results show that ammonia consumed a less chlorine, followed by organic compounds then activated sludge which consumed a large amount of chlorine. The results indicate that while chlorine concentrations at all flow rates may be efficient for inactivation of *E.coli* with higher resistant micro-organisms such as *Candida albicans*, only the chlorine concentration at the lower flow rate may be efficient. At higher flow rates of greater than 100 *l*/hr, the chlorine concentration may be not efficient.

As a general conclusion of this study, it could be stated that there is a possibility of exhausting all chlorine tablets before the period of checking by inspectors every 3 or 4 months. This is because the chlorine columns in johkasou contain about 90 organic tablets at a dissolution rate of 1.01 tablet/day. In the summer season, the tablets may be exhausted in less than 3 months. Although there is little change in the pH of Johkasou effluent, if the pH of influent water is made to acidic or alkaline, this will affect the solubility of organic and inorganic tablets and the formation of chloramine.

Organic tablets are efficient for the inactivation of *E.coli.*, but not efficient for inactivation of other resistant micro-organisms. For this, inorganic tablets are more efficient. Both kinds of tablets are required is to be used simulataneously in order to prevent the outbreak of epidemic disease. Inorganic tablets can be used in one column and organic tablets in tther columns.

To overcome the possibility of exhausting of all chlorine tablets, home owners can observe the johkasou and easily replace the tablets. If the recommended effluent chlorine concentration of 10 mg/*l* becomes essential, the number of chlorine columns must be increased on the disinfection chamber water inlet and the chlorine column should be redesigned in a way which increases the contact area between the water and tablets in the high flow rate and reduces it in the low flow rate. This will have great importance when using inorganic tables. Because inorganic tables are highly soluble, the low flow rate concentration is very high and may be dangerous for aquatic life.

〈教育報告〉　研究課程研究論文要旨

在宅看護従事者に対する現任教育のあり方に関する研究

牛久保　美津子

Study on continuing education for home health care nurses

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The purpose of this study was to identify the educational needs of, and make suggestions on these needs to home health nurses in order to upgrade their nursing skills. The survey was conducted with members of the Nursing Society for Intractable-Diseases as well as other home health care nureses introduced by these members. Survey questionnaires were sent to 172 subjects and the response rate was 94.2%. Excluding practical nurses, this study included only 125 registered nurses in the analysis.

The major findings in this study were as follows: Home health nurses who are young and have little clinical experience have the strongest educational needs for continuing education. The following skills are important for home health nurses and should be included into continuing educational program; interviewing skills and counseling, communication skills, high-tech clinical nursing skills, and independent decision-making.

The results of this survey suggested that increasing educational opportunities, preparation of nursing manuals, cultivation of clinical nursing specialists, a systematic continuing education program, and a system of quality assurance are needed for conprehensive home-health nursing education.

Supervisor: Tanji HOSHI

人生の終末期を自宅で過ごしたいというがん患者および高齢者のニーズ，ならびに高齢者訪問看護制度の推進や健康保険制度改定によって，さらには医療技術の進展により在宅療養の可能な患者が増えるなど，在宅看護ニーズは，年々急速に高まるとともに複雑化してきている．このため，わが国では，訪問看護婦による在宅看護はそれに追いつかず立ち遅れた状態であり，また，看護基礎教育においてもそれを重視するようなカリキュラム改訂が行われたばかりで在宅看護における教育は未確立・未整備な状態である．

そこで，本研究は，質の高い在宅看護を提供できるようにするための現任教育のあり方について提言することを目的に，3つの視点，すなわち，第1章「在宅看護の推進背景とその発展の方向」では在宅看護の動向を予測し，第2章「在宅看護従事者の実態調査」では，在宅看護婦の技術度とその教育背景の調査により教育ニーズを明らかにし，そして最後に第3章「在宅看護従事者の現任教育のあり方に向けての提言」では，今後の在宅看護ニーズに対応できるための在宅看護婦の現任教育のあり方を考察した．

第1章は，激変する国民ニーズと社会変化を文献から追い，在宅看護へのニーズの動向を把握した．その結果，高まる在宅看護ニーズは，従来の日常生活援助からハイテク看護へとその質を変えつつあり，それに対応するための在宅看護教育は未調整な状態であることが指摘された．

第2章では，在宅看護従事者の教育ニーズを明らかにすることを目的に実態調査を行い，1)在宅看護従事者の概要，2)在宅看護技術の実施率，困難率，教育希望率，3)技術修得のために利用している教育源，4)教

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育優先上の対象の背景について分析を行った.

対象は難病看護研究会に所属する在宅看護経験者およびその会員紹介による訪問看護婦の計172名で,郵送法による質問紙調査を実施した結果,計162名の有効回答を得た(有効回収率94.2%).そのうち,準看護婦を除く国家資格免許を保持する看護職(保健婦,助産婦,看護婦)のみ125名を分析対象とした.

調査結果は,以下のとおりである.対象の概要は,平均年齢42.1歳,看護通算経験は平均17.0年,訪問看護経験は平均6.8年,平均離職年数は2.9年であった.医療機関に所属する者は全体の約3割を占め,学歴は専門学校卒が約6割を占めていた.

在宅看護技術の実施率では,日常生活援助技術に高くみられ,高度専門的看護技術の実施率は低かった.困難率では,実施率が高い日常生活援助技術や基本的看護技術も実施率が低いためか困難率は低かった.しかし,一般的面接・カウンセリング技術,コミュニケーション技術に困難率が多くみられた.教育希望率は,困難率が高かった技術および高度専門的看護技術に高く見られ,実施率の多かった日常生活援助技術は困難率と教育希望率はともに低かった.

技術習得のために有効であった方法は,病院勤務が圧倒的に多く,それを参考書で補っているということが明らかにされた.一方,病院勤務では対応不可能な在宅看護技術としては,一般的・カウンセリング技術,ハイテク看護技術があげられた.

教育上優先すべき対象の背景は,医療機関以外に勤務する者,年齢が若く,看護経験が少ない者である.

第3章は,第1章と第2章を受けて,これらの在宅看護ニーズに対応するための現任教育のあり方について以下の提言をした.

(1)在宅看護に従事する多くの者が参加しやすいように,現在の教育のための研修の場や技術訓練の場が整備されるとともに,研修を優先すべき看護婦や非常勤者に対して研修受講の上で特に配慮されるように職場の理解を促す必要がある.

(2)現任教育の焦点は,一般的面接・カウンセリング技術,コミュニケーション技術,ハイテク看護技術の修得および看護婦の判断力・自立性の育成と療養者と家族のセルフケア力やインフォームドチョイスを支援する心理社会的能力の修得についてである.

(3)社会的ニーズに答えられるハイテク在宅看護技術の質の向上をめざすには,実施率をあげれるように,経験者を資源化することと,看護技術マニュアルを作成することが提案される.

(4)情報を常に更新するために,看護婦国家免許の更新などの定期的な教育の機会をシステム化する必要がある.

(5)医療技術の高度化に対応した看護サービスの質の向上を図るには,現段階では専門看護婦の育成が望まれる.

(6)被現任教育者は,ケアの質の向上をはかるために,看護研究を推進しながら情報の出力源の役割をも担うことが期待される.

(7)在宅看護の質を向上させるには,看護技術の質を保障するためのプログラムまたは支援体制が必要である.

〈教 育 報 告〉　　研究課程研究論文要旨

顆粒球中性プロテアーゼ ～カテプシンG～ の生理的意義

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Physiological functions of granulocyte cathepsin G

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Cathepsin G is a serine protease with chymotrypsin-like activity found in azurophil granules in human neutrophils and spleen cells, and has been reported to stimulate mouse B cells selectively Trypsin, which is also a serine protease, has been reported to have mitogenic activity on human lymphocytes *in vitro* and also to stimulate mouse B cells selectively. Since granulocytes that produce cathepsin G, are in close contact to lymphocytes *in vivo* and because a neutral extracellular environment is suitable for the action of this protease, cathepsin G is able to alter the functions of lymphocytes *in vivo*.

This study found that cathepsin G purified from human bone marrow cells stimulated the DNA synthesis in both human T cells and B cells, in contrast to a previous report that cathepsin G stimulated mouse B cells selectively. Moreover, this effect was more remarkable for T cells than for B cells. Among the T cell subsets, while $CD4^+$ T cells showed an increase in DNA synthesis, $CD8^+$ T cells did not. Cathepsin G was also found to increase intracellular free Ca^{2+} concentration ($[Ca^{2+}]i$), stimulate the production of inositol 1, 4, 5-trisphosphate (IP_3) and cause cytoplasmic alkalization in lymphocytes.

The results sugget, the following signal transduction pathway is initiated by cathepsin G. When lymphocytes are activated by cathepsin G, signals are transmitted across the plasma membrane to the cellular interior. These signals lead to phospholipase C activation and the production of IP_3 and diacylglycerol (DAG) by the breakdown of phosphatidylinositol phosphate. IP_3 causes the release of Ca^{2+} from intracellular stores. Concomitantly, or slightly after intracellular Ca^{2+} release, the influx of this cation across the plasma membrane is stimulated via the activation of the Ca^{2+} channel. DAG activates protein kinase C (PKC) and translocates it from the cytosol to the plasma membrane. PKC activation results in the stimulation of the Na^+/H^+ ion pump which leads to an increase in intracellular pH.

Supervisor : Yosuke AOKI

I　目 的

顆粒球は骨髄で熟成した後，末梢血中に遊出し，約7時間の半減期で，血管内から組織中に遊走して数日で崩壊する．この間，種々の刺激により，顆粒球からライソゾーム中の内容物が分泌され，生体内に様々な影響を及ぼしていると思われる．

顆粒球のライソゾームには，多くの酵素が存在している．なかでも，プロテアーゼでは，至適pHが酸性にある酸性プロテアーゼと至適pHが中性にある中性プロテアーゼとがある．酸性プロテアーゼは，生体内の通常のpHではほとんど作用できないため，顆粒球外では働けないのに対して，中性プロテアーゼは，顆粒球外での働きが主であると考えられる．すなわち，顆粒球中性プロテアーゼは，リンパ球等の血球に何らかの作用を及ぼしている可能性がある．

カテプシンGは，ヒト好中球のアズール顆粒に存在

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するキモトリプシン様活性をもつ中性プロテアーゼ(セリンプロテアーゼ)で，1974年に命名された．ついで，ヒトヒ蔵からもキモトリプシン様活性をもつプロテアーゼが発見され，好中球に存在するものと同じであることが確かめられた．カテプシンGは，非常に塩基性の強いタンパク質で，分子量は約26,000である．

1987年，U937 leukemic cell lineのmRNAからcDNAライブラリーが作製されクローニングがなされ，ヒトカテプシンGの一次構造が決定された．また，1989年U937promonocytic cellより，genomicライブラリーが作製されて，シークエンスが行われ，カテプシンG geneは，2.7kbpに広がり，5つのエクソンと4つのイントロンからなっており，染色体14q11.2上に位置してしることが明らかになった．

一方，代表的なセリンプロテアーゼにはトリプシン，キモトリプシンがあげられるが，これらのプロテアーゼは，ヒトリンパ球を活性化，すなわち，ヒトリンパ球に対してマイトジェニック活性を持つことが報告された．さらに，マウスリンパ球を用いた実験では，トリプシンはリンパ球のうち，Bリンパ球を特異的に活性化することがわかった．そして，カテプシンGもマウスBリンパ球を特異的に活性化することが報告された．カテプシンGを産生している顆粒球は生体内でリンパ球と相互作用する可能性が十分にあり，また，顆粒球などが存在する末梢血は中性でありカテプシンGが働くのに適しているので，このプロテアーゼが，顆粒球から放出された後，生体内でリンパ球に対して働き，リンパ球の機能を変化させることができると考えられる．

レクチンや抗原がリンパ球の表面にあるレセプターに結合するとリンパ球が活性化されるが，この際シグナルが膜を通り，細胞内部に伝達される．これらの結合によるレセプターの活性化により，まずホスハリパーゼCが活性化され，ホスファチジルイノシトールリン酸から，イノシトール三リン酸とジアシルグリセロールができる．イノシトール三リン酸は細胞内のカルシウムストアからカルシウムイオンを放出させる．それと同時かそれより少し遅れて細胞膜にあるカルシウムイオンチャンネルが活性化され，細胞外からカルシウムイオンが流入する．一方，ジアシルグリセロールは，プロテインキナーゼCを細胞質から細胞内膜に移動させる．このプロテインキナーゼCの活性化はナトリウム一水素イオンチャンネルの活性化につながり，細胞内のpHが上昇する．

そこで本研究においては，まずヒト骨髄からカテプシンGの精製を行い，カテプシンGが，ヒトリンパ球を活性化することを見つけ，さらに，カテプシンGがリンパ球を刺激する際，リンパ球の情報伝達系においてどのような変化をもたらすか調べた．すなわち，細胞内カルシウムイオン濃度の変化，イノシトール三リン酸の産生，細胞内pHの変化について調べた．

II 方法及び結果

1．カテプシンGの精製

まず，ヒト骨髄細胞よりカテプシンGを抽出し，DE52カラム，Sephadex G-100カラム，CM-cellulose カラム，Toyopearl HW-55カラムにかけ精製を行った．精製されたカテプシンGをポリアクリルアミド電気泳動したところ，報告されているパターンと同じものが得られ，初めてヒト骨髄からのカテプシンGが精製された．こうして得られたカテプシンGを用いて以下の実験を行った．

2．カテプシンGによるリンパ球の活性化

カテプシンGはヒトリンパ球のDNA合成能を増大させた．また，^{3}H－チミジンのリンパ球への取り込み量はカテプシンGの濃度に依存しており，7.5μg/mlの濃度で最もよく活性化された．なお，カテプシンGがこの濃度より高くなると，^{3}H－チミジンのリンパ球への取り込みは減少した．

また，カテプシンGはBリンパ球のDNA合成能も増大させた．しかし，^{3}H－チミジンのBリンパ球への取り込みは，その全リンパ球への取り込みに比べて低く，また，全リンパ球はカテプシンG7.5μg/mlの濃度で最もよく活性化されたのに対して，Bリンパ球は5.0μg/mlの濃度で最もよく活性化された．

さらに，カテプシンGはTリンパ球のDNA合成能も増大させた．^{3}H－チミジンのTリンパ球への取り込みは，その全リンパ球への取り込みと同様に，カテプシンG7.5μg/mlの濃度で最も良く活性化された．

次にTリンパ球をさらにCD4$^+$Tリンパ球とCD8$^+$Tリンパ球に分けて，同様の実験を行った．その結果カテプシンGはCD4$^+$Tリンパ球のDNA合成能を増

大させ，^{3}H－チミジンの取り込みは，全リンパ球への取り込みに比べて約2倍高かった．また，^{3}H－チミジンのCD4$^+$Tリンパ球への取り込みはその全リンパ球への取り込みと同様に，カテプシンG7.5μg/mlの濃度で最も良く活性化された．一方，CD8$^+$Tリンパ球のDNA合成能は，カテプシンG2.5-10.0μg/mlの濃度では全く変化がなかった．

3．細胞内カルシウムイオン濃度の変化

7.5μg/mlのカテプシンGによりリンパ球の細胞内カルシウムイオン濃度は上昇した．また，細胞内カルシウムイオン濃度はカテプシンGによる刺激で上昇した後，刺激よりも高い濃度を保ち続けた．

Bリンパ球，Tリンパ球，CD4$^+$Tリンパ球，CD8$^+$Tリンパ球ともに細胞内カルシウムイオン濃度はカテプシンGによる刺激で上昇した．このうち，Tリンパ球，CD4$^+$Tリンパ球，CD8$^+$Tリンパ球では細胞内カルシウムイオン濃度はカテプシンGによる刺激で上昇した後，刺激前よりも高い濃度を保ち続けたのに対し，Bリンパ球では上昇した後，短時間の後に刺激前の濃度に戻った．

4．カテプシンGによるヒトリンパ球細胞内イノシトール三リン酸が産生

7.5μg/mlのカテプシンGによりリンパ球の細胞内イノシトール三リン酸が生産されることがわかった．この細胞内イノシトール三リン酸の産生は，カテプシンGの刺激後30秒で顕著に増加し，刺激後1分で1×10^{7}個リンパ球あたり11.6pmolから27.7pmolにふえた．この増加した細胞内イノシトール三リン酸の量は刺激後5分まで持続した．

5．カテプシンGによるヒトリンパ球細胞内pHの変化

7.5μg/mlのカテプシンGによりリンパ球の細胞内pHは上昇することがわかった．カテプシンGの刺激後2秒で，リンパ球の細胞内pHは7.19から7.48まで上がった．その後は再び刺激前のpHに戻った．

III 考 察

以前，カテプシンGがBリンパ球のみを特異的に活性化すると報告されたが，本研究により，カテプシンGは，Bリンパ球のみならず，Tリンパ球も活性化することがヒトリンパ球を用いた実験により明らかとなった．そのうえ，Bリンパ球よりもTリンパ球をよりよく活性化することがわかった．また，本研究で用いたカテプシンGの濃度は，生体内のカテプシンGの濃度として報告のある6-12μg/mlという生理的濃度範囲にあるので，生体内でリンパ球を活性化している可能性が充分にあると考えられる．

一方，本研究により，Bリンパ球，CD4$^+$Tリンパ球，CD8$^+$Tリンパ球ともにカテプシンGの刺激により細胞内カルシウムイオン濃度の上昇が見られたのに対し，DNA合成能の増大はBリンパ球，CD4$^+$Tリンパ球においてのみ見られ，CD8$^+$Tリンパ球においては見られなかった．これは，Bリンパ球，CD4$^+$Tリンパ球とCD8$^+$Tリンパ球ではDNA合成へつながるシグナルの伝達様式が異なっているためではないかと思われる．

またさらに，本研究により，Bリンパ球とCD4$^+$Tリンパ球，CD8$^+$Tリンパ球ではカテプシンGによる刺激をうけたあとの細胞内カルシウムイオン濃度の変化に違いがあることがわかった．すなわち，Bリンパ球においては，カテプシンGの刺激により細胞内カルシウムイオン濃度が上昇した後，2－3分で刺激前の細胞内カルシウムイオン濃度に戻るのに対して，CD4$^+$Tリンパ球，CD8$^+$Tリンパ球ではカテプシンGの刺激により細胞内カルシウムイオン濃度が上昇した後，その濃度を保ち続けた．この違いは，細胞膜にあるカルシウムチャンネルの働きの違いによるものと思われる．

ところで，マウスに肝ガンをおこさせた実験では，前ガン段階で一時期カテプシンGの活性が上昇することがわかった．カテプシンGは，CD8$^+$Tリンパ球のDNA合成に変化をもたらさなかったが，カテプシンGによって活性化を受けたCD4$^+$Tリンパ球によって活性化された可能性がある．よってカテプシンGの活性の変動を調べることにより疾病の予知も可能になり，公衆衛生的に応用できると考えられる．

IV まとめ

以前，カテプシンGがBリンパ球のみを特異的に活性化すると報告されたが，本研究により，カテプシンGは，Bリンパ球のみならず，Tリンパ球も活性化することがヒトリンパ球を用いた実験により明らかとなった．そのうえ，Bリンパ球よりもTリンパ球をよ

りよく活性化することがわかった．また，本研究により，カテプシンGによるヒトリンパ球の刺激によって，リンパ球内の様々ないわゆる細胞内セカンドメッセンジャーと呼ばれるものに変化が起こっていることがわかった．つまり，カテプシンGによるヒトリンパ球の刺激によって，細胞内カルシウムイオン濃度の上昇，イノシトール三リン酸の産生，細胞内pHの上昇が起こっていることが明らかになった．しかし，カテプシンGが，リンパ球の細胞膜上のどの分子を認識して細胞内に刺激を伝えているのかは今のところわかっていない．今後カテプシンGが認識するリンパ球の細胞膜上の分子の特定を行うことが課題である．

〈教育報告〉 研究課程研究論文要旨

韓国の人口転換と出生力の低下要因の変化に関する研究

趙 南勲

Demographic transition effects on of fertility decline in the Republic of Korea

Nam-Hoon CHO

本研究では、1960-1991の国勢調査および国民出生家庭保健調査のデータに基づいて、1962年以来の韓国の出生力低下に寄与した構造要因・近接要因を明らかにし、出生力決定要因の変化を検討した。

構造要因については、standardization approachの適用により、1960-1970, 1980-1990の出生率の低下は主に有配偶出生率の低下によるものであることが明らかになり、近接要因については、Bongaats modelの適用により、「結婚年齢の上昇」「人口妊娠中絶の増加」「避妊実行率の上昇」の三者が、出生力低下の三大近接要因であることが明らかになった。

出生力決定要因の変化に関しては、比例ハザードモデルの適用による妊娠間隔の検討およびロジスティック回帰モデルの適用による妊娠の帰趨並びに出生力の検討を行った結果、妻の教育レベルと既出生児の性構成が二大要因として見いだされた。

妻の教育の高さは、初妊婦の年齢を大きく引き上げ、妊婦の帰趨を人工妊娠中絶に導く方向の影響を与えていた。既出生児の性構成については、既に男児をもっている夫婦では、それ以降の妊娠の大きな減少、および妊娠の帰趨が人口妊娠中絶となる比率のかなりの増加がみられた。

Supervisor : Kenji HAYASHI

Occurring simultaneously with rapid socio-economic development, Korea has now completed the entire process of demographic transition with the successful implementation of a national family planning program that started in 1962. It is estimated that if the current level of below replacement fertility continues, the population in Korea will stabilize at around 50.6 million by the year 2021, and will then begin to decrease thereafter. These demographic changes suggest that new population policy directions and strategies for the 21st century may have to be sought paying careful attention to the changes in various socioeconomic and demographic factors which have been most influential in the country's rapid decrease in fertility.

The current study aims to identify the structural and causal factors contributing to fertility decline in Korea over the last three decades since the population control policy, and a series of five-year economic development plans were initiated, and to examine the determinants of fertility and their changes over time. This study was based on the population census data of the National Statistical Office (NSO) and the national fertility and family health survey data of the Korea Institute for Health and Social Affairs (KIHASA) conducted for the period from 1960 to 1991.

The main methods used in this study were the

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standardization approach to examine the effects of structural factors on fertility decline, and the Bongaarts model to measure the effects of proximate variables on fertility decline.

The results showed that the fall in both the crude birth rate (CBR) and the general fertility rate (GFR) for the periods for 1960 to 1970, and from 1980 to 1990, were largely influenced by the decline in marital fertility triggered by the 1962 national family planning program. The Bongaarts model analysis revealed that the factors which exercised the strongest influence on fertility decline were a rise in age at marriage, an increase in abortion procedure, and on increase in contraceptive use.

The influence of induced abortion,however, has been decreasing in recent years, and additionally, a decrease in postpartum infecundability has had a negative influence on fertility decline since 1960. This implies that breastfeeding should be promoted since it is important for infant health and contributes to chlid-spacing, and that the provision of contraceptive services to ensure birth-spacing needs to be improved inorder to minimize the incidence of illegitimate and/or unwanted births, and induced abortions.

The second part of the analysis was divided into two parts; estimation of pregnancy intervals using a proportional hazards model, and estimation of the determinants of fertility with a logistic regression model in order to ascertain whether a pregnancy terminates in a live birth, or in an abortion.

In both analyses the sex composition of previous children and womens' education were the main independent variables. Womens' education showed a significant effect on delaying the timing of the wife's age at first pregnancy, but effect on the pace of subsequent pregnancies is much smaller and was often positive. On the other hand, womans' education had consistently positive effect on the probability of a pregnancy ending in an abortion, although this effect showed a study decline over time.

From the first parity, the sex composition of previous children stands out as the most important factor in deciding both the pace of future pregnoncies and their outcome. The pregnancy risks of women with sons were reduced by almost one-half at the second and third parities. The probability of a pregnancy ending in an abortion also increased substantially when parents already had a son. Since the pace of fertility reduction has been faster than the pace at which the parental son preference has been weakening, the strong preference for sons has made the sex of children a more important factor in the determination of Korean fertility. Womens' education, on the other hand, has become a less important factor.

There has been a trend in recent years, for on increase in the sex-ratio. According to the vital registration data, the sex ratio of third births increased from 110 in 1982 to 190 in 1989, and from 113 to 217 during the same period for fourth births. This is attributed to the fact that those parents with no male heir are willing to go on to the next higher parity, and sex selection procedures have been used more often by parents. The study estimates that the number of elective abortions in 1989 was about 19,000. The sex ratio at birth is already at an unprecedently high level in Korea, and elective abortion has become a serious social and ethical issue.

The national family planning program has accomplished its primary goals of fertility reduction and universal contraceptive use, and consequently the trend in recent years for a decline in fertility shows no signs of reversal. Demographic changes suggest that the main concerns of the national family planning program should be shifted from the prior quantitative approach, with emphasis on fertility reduction, to a qualitative approach for enhancing the population quality. Future family planning programs should focus on the improvement of program quality and use-effectiveness of contraceptive measures, the maintenance of a balanced sex ratio, and

on a reduction of induced abortions. Of particular importance is that the sex ratio of births has changed in recent years due to an increase in elective abortions triggered by parental sex preferences.

In a changing socioeconomic and cultural environment, the decline in fertility has important implications for issues such as care of the elderly and labor force supply, and Korea should therefore modify its policies in order to accommodate these new dimensions in population dynamics. Accordingly, the future directions and strategies of population policy should be primarily focused on social welfare rather than on demographics.

The current family planning program can again play a crucial role, The major anticipated shifts in policy options and directions for the immediate future are : 1.) to improve the current family planning program management system inorder to achieve a greater acceptance of contraception among those in their 20s or those with low parity in order to increase birth spacing, and in order to have a wider variety of contraceptive methods available, 2.) to shift from free contraceptive services provided by government support to a more self-supporting system through the commercial sector, 3.) to enhance the quality of contraceptive services in order to reduce the incidence of induced abortions, 4.) to promote breastfeeding for infant health and child spacing, 5.) to integrate family planning with maternal and child health and social welfare programs, 6.) to strengthen social and institutional support policies for a mere balanced sex ratio through improved womens' social status and equality of the sexes, and 7.) to expand the scope of family planning to cover the unmarried sector of the population in order to prevent premarital pregnancies.

In order to overcome various problems associated with family planning as well as the many challenges of below replacement fertility, the importance of current family planning should not be underrated just because of low fertility rates. Finally, it is necessary to continue to conduct population/family planning research studies in the context of policy changes and changes in socio-economic and demographic conditions. More efforts should be made to help keep policy makers, planners, and administrators informed about current and prospective population and fertility trends.

〈教育報告〉 研究課程研究論文要旨

韓国における人工妊娠中絶現状とその人口学的効果分析

洪　文植

Analysis of induced abortion status and its demographic effects in Korea

Moon Sik HONG

韓国の出生数は1963年以来減少を続けているが，背後には人工妊娠中絶の少なからぬ寄与があるものと考えられた．そこで本研究は，韓国の人工妊娠中絶の現状を明らかにし，出生力の低下に対する寄与を検討した．データは主として1991年の国民出生家庭保健調査に基づいた．

韓国の人工妊娠中絶は1970年代に急激な上昇をみせたが，1980年代に入ると，全体としては低下傾向を示している．しかし，中絶の経験率は，相変わらず1985年の水準(53%)に止まり，まだ，妊娠の帰趨が出生となる比率は1979-81の60%に対して，1982-90には53-54%と低下しており，一概に中絶が減少しているともいえない．

この背後には，中絶を支える意識があると考えられる．実際，妊娠（胎児の性）が望まないものであった場合に中絶を考える女性は80%（30%）であり，また中絶をそのまま家族計画の方法であると考える女性も23%に達した．

韓国の出生力の低下に対して中絶の及ぼした効果を見るため，出生力の低下に影響した近接要因の評価を行ったところ，「結婚年齢の上昇」「人工妊娠中絶の増加」「避妊実行率の上昇」が三大要因であること，1960年代には「結婚年齢の上昇」が最大要因であったが，その後「避妊実行率の上昇」と並んで「人工妊娠中絶の増加」の比重が高まり，1970年代の末にピークに達したことが明らかになった．

Supervisor: Kenji HAYASHI

Induced abortion has become one of the most important factors in the reduction of fertility in Korea especially since 1970s. This is despite the continued governmental effort and support for family planning programs including supply of contraceptives, such as the pill, condoms, IUDs, and both male and female sterilization procedures other than abortions, and carries with it profound population policy implications.

This study was conducted in order to review the general picture of induced abortion in Korea and to examine how induced abortion affects the fertility decline in the Korean family planning program. Data for analysis were mostly from the results of the 1991 Fertility and Family Health Survey conducted by the Korea Institute for Health and Social Affairs.

Along with a continuous decrease in the fertility rate, the rate of induced abortion continued to increase sharply in the 1970s. The fertility rate, however, has been steady at 1.6 since 1988 while the induced abortion experience rate has been stationary at 53 percent since 1985.

In the 1980s, while age specific induced abortion rates among women 30 years or older had a sharp decrease, there was continuous increase among

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young women of 29 years or younger. The overall induced abortion rate, however, decreased in the 1980s. In the other words, the annual number of induced abortions per 1,000 married women decreased from 113.3 in 1981 to 63.6 in 1990 and the absolute number of induced abortions also decreased, from about 590,000 cases in 1980 to about 400,000 cases in 1990. Nevertheless, the live birth rate among total pregnancies decreased from 60 percent during 1979-1981 to 53-54 percent in 1982 -1990 resulting in an increase of non parcus pregnancies especially by induced abortions.

About 23 percent of women believe in induced abortion as a means of family planning, though most women (93%) believe induced abortion is harmful. 60 percent of women are not familiar with the legal status of induced abortions. However, about 80 percent of the women responded that they would accept an induced abortion if they had an unwanted pregnancy and 30 percent responded they would accept an induced abortion if the sex of fetus was not the desired one.

Responses regarding health problems experienced after an induced abortion was 26.3 percent for the first abortion, 31.3 percent for the second, and 42.3 percent for the third or greater. It is clear from these days that repeated abortions create more health problems.

In the correlation analysis between the related variables of fertility and abortion, fertility showed the highest correlation with the total number of pregnancies and the age of the mother, and induced abortion with the total number of pregnancies.

The number of births terminated and the proportion of births terminated to the births by induced abortion increased until 1987. Since then they have been decreasing while the number of births has been decreasing continuously since 1963. As a result, the estimated number of births terminated by abortion from 1963 to 1990 is about 1,227,000 in total.

According to the analysis of estimating the effect of factors on the reduction of the Korean fertility rate, the increasing proportion who married at a later age was the most important factor in fertility reduction in 1960s. With the official adoption of a family planning program in 1962, however, the effect of both contraception and induced abortion on fertility have increased significantly while effects of later marriage have decreased. Despite the government's efforts to promote family planning, the demographic effect of abortion on fertility reduction has remained quite high peaking in the late 1970s. Regarding population policy, implication it should be noted that both induced abortion and contraception apparently become the most important factors in the reduction of fertility in the mid-1970s.

As a result, it has been proven that a significant effect of induced abortion on the fertility decline was made through the prevention of live births.

In terms of promotion of maternal and child health, a strong strategy to prevent induced abortion through the improvement of contraceptive service quality is required. Especially for women who need pregnancy termination, sterilization services provided by the government should be maintained at a considerable level as has been planned at the 7th national socio-economic development plan.