with colicins, which suggests that colicins do not activate this death pathway in BM2 cells (not shown).

Discussion

Cytotoxic and cytocidal activities of colicins against standard, non-transformed mammalian tissue cells (including the human ones) have been demonstrated on several models. For example, colicin E3 killed the line L mouse fibroblasts (Šmarda et al., 1978). In addition, it efficiently inhibited the concanavalin A-induced mitogenic activation of mouse lymphocytes and their homing into the lymph nodes (Viklický et al., 1979) and suppressed viability of monkey kidney cells as well as of human diploid embryonal lung cells in cultures (Šmarda, 1983). Colicins E1, E3 and E5 were found to decrease the number of growing cells in cultures of Chinese hamster fibroblasts V79 (Šmarda and Kepртová, 1987). As far as a comparison could be drawn, tumor cells appeared to be generally more susceptible than normal cells.

The results presented here show that v-*myb*-transformed chicken monoblasts BM2 are sensitive to colicins E1 and E3. Colicin concentrations 0.5 and 1.25 μg/ml decreased the number of viable cells proportionally. The inhibitory effect was more prominent for colicin E3, suppressing growth of BM2 cells by 70% within 3 and 4 days of treatment at the concentration 1.25 μg/ml. In contrast, colicin E1 (1.25 μg/ml) inhibited BM2 cells most efficiently within 1 and 2 days of treatment, decreasing their viability by 57% and 61%, respectively. An exposition of BM2 cells to colicin E1 for 3 and 4 days resulted in weaker inhibition (30% and 38%, respectively). A decrease in viable cell number induced by colicins can result either from an inhibition of their proliferation or from increased rate of cellular death processes. Cell-cycle analysis did not show dramatic changes in proportions of G1, S and G2/M phase cells, suggesting that the effects of colicins are not cell-cycle specific. Therefore, we can hypothesize that colicins E1 and E3 do not arrest growth of chicken monoblasts by slowing down the cell cycle at certain control points, but that they rather decrease the number of viable cells by a cytotoxic effect. Because the frequency of programmed cell death in BM2 cells is not affected by colicins, we can conclude that colicins kill these cells rather by necrosis than by activating apoptotic cell death pathways. Tumor suppressive effects of colicin E1 were also tested in four human tumor cell lines. G1-phase-specific growth arrest and increased frequency of apoptosis were observed only in the cells of mammary carcinoma cell line MCF7. Interestingly, only this cell line produces the wild-type p53 protein, while the other three cell lines produce its mutant derivatives. These results suggest that cell-cycle-specific growth arrest and apoptosis induced by colicins may be p53-dependent.

In general, our results confirm the specific inhibition of tumor cells induced by pure colicin E3, quoted above. A similar effect is shown here for colicin E1. This is the first statement of such an effect for this colicin. The bactericidal effect of colicin E1 is due to its depolarizing attack on the plasma membrane of bacterial cells, while that of colicin E3 to its specific rRNA exonuclease effect (Braun et al., 1994). The molecular mode of action on eukaryotic cells remains to be elucidated.

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