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Title: Effect of replacement calves' housing, individual, paired or individual adjacent pens, on health, feed intake, feed efficiency, growth, welfare and production as primiparous

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Abstract

Introduction: the common practice for replacement calves housing in the Israeli dairy industry is to rear them in an individual pens until age 50 -60 days when transferred to a group housing. This practice does not meet the highest standards for animal welfare as is prohibit the natural formation of social relation and may impair adaptation capabilities during later stages in lactating cows' life cycle. Accordingly, the Fourth edition of the American Guide for the Care and Use of Agricultural Animals in Research and Teaching (AGguide, 2020) states that suckling calves, regardless of propose (meet or dairy) required to be housed in a conditions that allows bonding with at least another calf. This instruction along with rising public and farmers' awareness towards animal welfare encouraged the examination of a method to improve suckling calves welfare by allowing social connection without increasing risk of disease transmitting which does not required massive investment or drastic managements' changes. In this research we offered an intermediate solution – housing suckling replacement calves in an individual pens attached to another one. This methods provide each calf with its own access to feed, water, and bedding while allowing physical connections with the adjacent calf.

Research objective: examine the effect of housing management, individual, paired, or individual adjacent pens, on growth, feed intake, welfare, fertility and production during first lactation.

Methods: the trial conducted in the nursery of Volcani's research dairy farm. Eighteen couples of female calves (total of 36 animals within 6 blocks) placed, alternatively and immediately after calving, to one of the following housing: individual pens as the common practice, paired pens, or adjacent individual pens. Daily data of feed intake, weekly data of body weight, and images collected from calving to rearing at age 56 days and another 7 days. Hair from the tail collected at day 1, 28 and 56 followed by cortisol concentration measurement. Body weight recorded at age 180 days, at first calving and at peak lactation. In addition we collected data of insemination success rate for first gestation and milk yield during the first 100 days of first lactation.

Results and discussion: average daily gain (ADG, kg/d) of the pair housed calves were higher than those housed in the individual pens with those housed in adjacent pens between them (0.79, 0.72, and 0.69 kg/d for paired, adjacent, and individual pens, respectively. $P = 0.04$). There was no effect of housing on feed intake along all the trial but there was some increase in feed intake for individual housed calves before calving. It may be that the increased intake enhanced rumen development which reflected in the higher body weight when reared. There was a smaller accumulation of hair cortisol between age one to 28 days for the adjacent pens' calves (-2.07 vs -0.31 and -0.03 pg/mg for adjacent, paired and individual pens, respectively, $p = 0.03$). This result may imply on higher welfare and less stress when housed in individual adjacent pens. There was no effect of housing on body weight at age 180 days, after first calving, or at first lactation peak. There was no effect of housing on insemination success rate that averaged around 2.1 inseminations for first gestation. Out of 36 calves participated in the trial, 31 made it to first lactation. Initial records of production data during first 50 days of first lactation revealed tendency toward higher milk yield for the cows that were housed and reared in individual pens (33.5 vs 30.8 and 28.6 kg/d for individual, paired and adjacent pens, respectively. $P = 0.07$). In light of this results and as long as more data on the long term effects of housing during early life on later production is collected from this research or published in others, we recommend not to abundant the common practice of rearing replacement calves in individual pens which not allowed physical connection. It should be noted that according to the AGguide (2020) this practice does meet the minimal criteria for animal's social needs as long as calves are visible to each other and in relatively close proximity even without enable touching.