



Animal welfare and needle-free vaccination.

Dr. E. Marco, Marco Vetgrup; SLP

Introduction:

In recent years we have talked a lot about animal welfare, but the interpretation that each one makes of this term is not always the same. Animal welfare is a state within the animal. From a scientific perspective, 3 conceptual frameworks should be distinguished when one tries to evaluate animal welfare (Fraser 2003): biological functioning, affective state and natural life. The first conceptual framework it refers to the physical well-being of the animal. It is almost always the concept of well-being that a veterinarian has: an animal free of disease or injury has a better well-being than the sick or injured one, even if this requires confining it. The second conceptual framework refers to the psychic well-being of the animal. The welfare state is likely to be negative when the predominant affects experienced are unpleasant, and vice versa. A good proportion of welfare studies combine these two concepts, because in some way they are related since when the correct biological functioning is compromised, unpleasant sensations such as hunger, pain, fear, helplessness, frustration or anger appear. The third conceptual framework refers to the fact that animals have to be able to express their natural behavior in order to feel good. While a veterinarian is concerned about the first conceptual framework, an ethologist would be concerned about the latter. Thus, a pig should be able to roam, explore, play or have a sexual activity, among others, to consider that it is in a situation of well-being.

Without losing sight of this complex conception of animal welfare, any measure that manages to improve or preserve health, that reduces unpleasant sensations, or that allows a better expression of their natural behavior improves the welfare of pigs. In this sense, could intradermal vaccination be considered an element to improve the welfare of pigs?

Intradermal vaccination and physical well being

When needle syringes are employed, there is usually a needle that bends or even breaks, being able to get trapped inside the muscle of the pig and later generating problems during cutting and, of course, economic discounts for having to eliminate pieces of the carcass. Welfare is compromised when this happens as it produces pain and increase the risk of local infection, as happens when tissue damage occurs as a result of loss of sharpness of the needle. Intradermal vaccination eliminates these risks, representing an improvement in the physical welfare of the pigs. However, intradermal vaccination does not completely eliminate the

risk of pain as consequence of lesions occurring at the point of inoculation such as abscesses, granulomas or fibrosis, since in any case the injected vaccine product is the one that could generate a local reaction leading to this type of injuries. But the frequency of these phenomena is reduced when needle-less system is used, as could be seen in a study carried out in Korea. In this study it was shown that vaccination against foot-and-mouth disease using a transdermal inoculation system reduced the incidence of lesions by almost 15% ($p < 0.001$) and lesions were found just in the subcutaneous tissue with respect to the conventional needle injection system. A recent Spanish study also confirms these findings, in this case, they looked at blood levels of C-reactive protein and haptoglobin as reflex of acute phase response and muscle damage, finding lower levels in the group of pigs vaccinated intradermally compared to those vaccinated intramuscular.

The intradermal vaccination has an additional advantage: by not using a needle the possibility of transmission of pathogens between individuals would be limited. In the early stages, even in high health status farms, it is not uncommon to have an animal infected by *Streptococcus suis* or *Glässerella parasuis*, these germs generate septicemia and, in the case of using an intramuscular vaccination, without using a new needle for each individual pig, the vaccination would represent a risk of infection which could put the physical well-being of the animal at risk.

Intradermal vaccination and psychic well being

The advantages of using the intradermal vaccine on the physical well-being of the animals seem quite clear, but can it have any benefit on the psychological well-being?

The state of psychic well-being of a pig will be negatively affected when the predominant affects experienced are unpleasant. Therefore, reducing the possibility of developing local injuries or systemic diseases will obviously have a positive impact not only on the first conceptual framework of animal welfare (biological functioning) but also on the second (affective state) since the pain and unpleasant sensations derived from those injuries or diseases are consequently reduced. But what is the impact that vaccination itself can have on how a pig feels? Assuming that the intradermal vaccination system is less aggressive, it should result in a more pleasant experience and therefore improve the welfare of the pig.

But is it really so?

In the same Spanish study that has been commented previously, they also investigated whether intradermal vaccination reduced the sensation of pain at the time of vaccination. To verify this, the number of pigs showing high-pitched vocalizations and those showing retreat attempts at vaccination were counted. They found that the animals vaccinated intradermally behaved the same as the controls that were managed identically but did not receive any vaccine injection.

Table 2. Percentage of pigs showing retreat attempts and high pitch vocalizations at the time of injection in the CONTROL, Intradermal (IDAL), and Intramuscular (IM) groups.

Variable	Control	IDAL	IM
% of pigs with high pitch vocalization	7% ^b	7% ^b	32% ^a
% of pigs with retreat attempts	3% ^b	7% ^b	39% ^a

^{a,b} Different letters indicate significant differences between treatments (CONTROL; IDAL; IM).

Intradermal vaccination and expression of natural behavior

Taking into consideration what has been commented in the previous points, it would be logical to think that if intradermal vaccination improves physical and psychological well-being of pigs, they should behave more naturally, which in turn also improves their well-being.

The same Spanish study investigated what was the behavior expressed by the pigs the day after being vaccinated and, curiously, the pigs that had been vaccinated intradermally behaved similarly to the controls while those vaccinated intramuscularly showed some changes. To evaluate the activity of the animals, different behavioral variables were controlled: negative social behavior, positive social behavior, drinking, eating, exploring the corral, exploring the enrichment

material (in this case: ropes), sleeping, lying ventrally, lying laterally, sit or stand. Pigs vaccinated intramuscular showed a lower frequency of social negative interactions ($p = 0.001$) and rope manipulation ($p = 0.04$) in other words a decreased activity compared to the intradermal and control group. These are small changes, but they show that intradermal vaccination would be a less aggressive system and therefore it would interfere less in what is the normal behavior of the pigs improving their well-being.

Conclusions

The evaluation of the well-being of pigs is not easy, but if we take into account the 3 conceptual frameworks, intradermal vaccination is a tool that allows improving the well-being in each of their conceptions, being therefore a tool to take into account in our daily practice.

References:

- Fraser D. Assessing animal welfare at the farm and group level: the interplay of science and values. *Animal Welfare* 2003, 12, 433–43.
- Ko, E.Y.; Cho, J.; Cho, J.H.; Jo, K.; Lee, S.H.; Chung, Y.I.; Jung, S. Reduction in lesion incidence in pork carcass using transdermal needle-free injection of foot-and-mouth disease vaccine. *Korean J. Food Sci. Anim. Resour.* 2018, 38, 1155–1159.
- Temple, D.; Jiménez, M.; Escribano, D.; Martín-Valls, G.; Manteca, X. Welfare Benefits of Intradermal Vaccination of Piglets. *Animals* 2020, 10, 1898; doi:10.3390/ani10101898