REFERENCES

Abelardo, C. C., Leonel, A. R., Aurelio, R. V., Dennis, V. A. and John, F. S. 2002. Publicado como articulo en Agrociencia. 36: 531–539.

Armstrong, D. V., Denise, S. K., Delfino, F. J., Hayes, E. J., Grundy, P. J., Montgomery, S., and Correa, A. 1993. Comparing three different dairy cattle cooling systems during high environmental temperatures. J. Dairy Sci. 76 (Suppl. 1): 240.

Armstrong, D. V. 1994. Heat stress interaction with shade and cooling. J. Dairy. Sci. 77: 2044-2050.

Association of official Analytical Chemists. 1990. Official methods of analysis. Vol. I. 15th ed. AOAC, Arlington, VA.

Attenbery, J. T. and Johnson, H. D. 1969. Effects of environmental temperature controlled feeding and fasting on the rumen motility. J. Anim. Sci. 29: 734-737.

Bargo, F., Muller, L. D., Delahoy, J. E. and. Cassidy, T. W. 2002. Performance of high producing dairy cows with three different feeding systems combining pasture and total mixed rations. J. Dairy. Sci. 85: 2948-2953.

Beede, D. K. and Collier, R. J. 1986. Potential nutritional strategies for intensively managed cattle during thermal stress. J. Anim. Sci. 62: 543-554.

Bernabucci, U., Bani, P., Ronchi, B., Lacetera, N. and Nardone, A. 1999. Influence of short and long term exposure to a hot environment on rumen passage rate and diet digestibility by Friesian heifers. J. Dairy Sci. 82: 967-973.

Bouraoui, R., Lahmar, M. and Majdoub, A. 2002. The relationship of THI with milk productions of dairy cows in a miditerranean climate. Anim Res. 51: 479–491.

Brody, S. 1948. Environmental physiology with special reference to domestic animals I. Physiological backgrounds. Mo. Res. Bul. 423: 1–43.

Chaiyabutr, N., Presksagorn, S., Komovlavanich, S. and Chanpongsang, S. 1999. Urea and allantoin in milk of crossbred Holstein cattle feeding on different types of roughage. Inter. J. of Anim Sci. 14: 9-16.

Chen, X.B. 1989. Excretion of purine derivatives by sheep and cattle and its use for the estimation of absorbed microbial protein. Ph.D. thesis. Univ. Aberdeen, Scotland.

Chen, X. B., DeB, F. D. and Orskov, E. R. 1990. Excretion of purine derivatives by ruminants: Recycling of allantoin into the rumen via saliva and its fate in the gut. Br. J. Nutr. 63: 197-205.

Chen, X. B. and Gomes, M. J. 1992. Estimation of microbial protein supply to sheep and cattle based on urinary excretion of purine derivatives: An overview of technical details. Int. Feed Res. Unit, Occasional Publ. Rowett Research Institute, Aberdeen, United Kingdom.

Chen, K. H., Huber, J. T., Theurer, C. B., Armstrong, D. V., Wanderly, R. C., Simas, J. M., Chan, S. C. and Sullivan, J. L. 1993. Effect of protein quality and evaporative cooling on lactational performance of Holstein cows in hot weather. J. Dairy Sci. 76: 819.

Christropherson, R. J. and Kennedy, P. M. 1983. Effect of the thermal environment on digestion in ruminants. Can. J. Anim. Sci. 63: 477-496.

Colditz, P. J. and Kellaway, R. C. 1972. The effect of diet and heat stress on feed intake, growth and nitrogen metabolism in Friesian, F1 Braham × Friesian, and Brahman heifers. Australian J. Arg. Res. 23: 717.

Collier, R. J., Beede, D. K., Thatcher, W. W., Israel, L. A. and Wilcox, C. J. 1981. Influence of environment and its modification on dairy animal health and production. J. Dairy Sci. 65: 2213-2227.

Cowan, R. T., Moss, R. J. and Kerr, D. V. 1993. Summer feeding systems. Tropical Grasslands. 27: 150–161.

Curtis, S. E. 1981. Environmental management in animal agriculture. Animal Environmental Services, Mahomet, Il.

Dado, R. G. and Allen, M. S. 1994. Variation in and relationships among feeding, chewing and drinking variables for lactating dairy cows. J. Dairy Sci. 77: 132.

Demerle, C. and Goddard, M. E. 1986. Assessment of heat stress in dairy cattle in Papua New Guineam. Anim Health Prod. 18: 232–242.

Du Prez., Hatting, P. J., Giesecke, W. H. and Eisemberg, B. E. 1990. Heat stress in dairy cattle and other livestock under Souther African conditions. III. Monthil THI mean values and their significant in the performance of dairy cattle. J. Vet. Res. 57: 243 – 248.

Eigenberg, R. A., Hahn, G. L., Nienaber, J. A., Brown-Brandl, T. M. and Spiers, D. E. 1999. Development of a new respiration rate monitor for cattle. Trans. ASAE. 43: 723 -728.

Elvinger, F., Natzke, R. P. and Hansen, P. J. 1992. Interaction of heat stress and bovine somatropin affecting physiology and immunology of lactating cows. J. Dairy Sci. 75: 449-462.

Erwin, E. S. 1961. Volatile fatty acid analysis of blood and rumen fluid by gas chromatography. J. Dairy Sci. 44: 1768-1771.

Faichney, G. J. 1975. The use of markers to partition digestion within the gastrointestinal tract of ruminants. Digestion and Metabolism in the ruminant. McDonld, I. W. and Warner, A. C. I. (eds). 277 p. Univ. New England Publ. Unit, Armidale, New South Wales. Australia.

Finch, 1984. Heat stress as a stress factor in herbivores under topical conditions. In: Gilchrist, F. M. C. and Mackie, R. I. (eds), Herbivore nutrition in the tropics. pp. 89–105. The Science Press, Craighall, South Africa.

Gaughan, J. B., Holt, S. M., Hahn, G. L. Mader, T. L. and Eigenberg, R. E. 2000. Respiration rate is it a good measure of heat stress in cattle. Asian – Australian. J. Anim Sci. 13: Supplement C: 329–332.

Giesecke, D., Ehrentreich, L. and Stangassinger, M. 1994. Mammary and renal excretion of purine metabolism in relation to energy intake and milk yield in dairy cows. J. Dairy Sci. 77: 2376-2381.

Goering, H. K. and Van Soest, P. J. 1970. Forage fiber analyses (Apparatus, Reagents, Procedures, and Some Applications) Agric. Handbook No. 379. ARS-USDA, Washington, DC.

Gonda, H. L. and Lidberg, J. E. 1997. Effect of diet on milk allantoin and its relationship with urinary allantoin in dairy cows. J. Dairy Sci. 80: 364-373.

Grovum, W. L. and Williams, V. J. 1973. Rate of passage of digesta in sheep. Br. J. Nutr. 30: 313–329.

Hafez, E. S. E. 1968. Adaptation of Domestic Animals. Lea and Febiger. 430 p. Philadelphia.

Hahn G. L. and Mader, T. L. (1997). Heat waves in relation to thermoregulation, feeding behavior and mortality of feedlot cattle. In: Proceedings of the 5th International Livestock Environment Symposium Minneapolis, 29-31 May. ASAE, St Joseph, Mich, pp. 563 - 567.

Hahn, G. L. 1999. Dynamic responses of cattle to thermal heat loads. J. Anim. Sci. 77: 10-20.

Holter, J. B., West, J. W., McGilliard, M. L. and Pell, A. N. 1996. Predicting *ad libitum* dry matter intake and yield of Jersey cows. J. Dairy Sci. 79: 912-921.

Huber, J. J., Higginbotham, G., Gomez – Alarcon, R. A., Taylor, R.B., Chen, K. H., Chan, S. C. and Wu. Z. 1994. Heat stress interactions with protein, supplemental fat and fungi cultures. J. Dairy Sci. 77: 2080.

Huhnke, R. L., McCowan, L. C., Meraz, G .M., Harp, S. L. and M. E. Payton. 2001. Determining the frequency and duration of elevated temperature-humidity index. ASAE Meeting Paper No. 01-4111. St. Joseph, MI. ASAE.

Igono, M. O., Jotvedt, G. and Sanford-Crane,H. T. 1992. Environmental profile and critical temperature effects on milk production of Holstein cows in desert climate. Int. J. Biometerol. 36: 77-87.

Itoh, F., Obara, Y., Rose, M. T., Fuse, H., Hashimoto, H. 1998. Insulin and glucagons secretion in lactating cows during heat exposure. J. Anim. Sci. 76: 2182-2189.

Johnson, H.D., Kibler, H. H., Ragsdale, A. C. and Shanklin, M. D. 1960. Effect of various combinations of temperature and humidities on milk production. J. Dairy Sci. 43: 871.

Johnson, H. D., Ragsdale, A. C., Berry, I. L. and Shanklin, M. D. 1963. Temperature-humidity effects including influence of acclimation in feed and water consumption of Holstein cattle. 846 p. Univ. of Missouri Res. Bull.

Johnson, H. D. 1980. Environmental management of cattle to minimize the stress of climate changes. Int. J. Biometeor. 24: (Suppl. 7, Part 2) 65–78.

Johnson, H. D. 1985. Physiological responses and productivity of cattle. Stress physiological in livestock. Basic principles. 1: 4-19.

Kelly, R. O, Martz, F. A. and Johnson, H. D. 1967. Effect of environmental temperature on ruminal volatile fatty acid levels with controlled feed intake. J. Dairy Sci. 50: 531.

Kibler, H. H. and Brody, S. 1950. Environmental physiology with special reference to domestic animals. X Influence of temperature, 5 to 95^{O}F on evaporative cooling from the respiratory and exterior body surfaces of Jersey and Holstein cows. Missouri Agr. Exp Sta. Res. Bul. 461: 1–19.

Legates, J. E., Farthing, B. R., Casady, R. B. and M. S. Barrada. 1991. Body temperature and respiratory rate of lactating dairy cattle under field and chamber conditions. J. Dairy Sci. 74: 2491-2500.

Lebzien, P., Giesecke, D., Wiesmayr, S. and Robr, K. 1993. Messung der mikrobiellen proteinsynthese im pansen von huhen mittels ^{15}N-Bestimmung im duodenalchymus und allantoinausscheidung in der Milch. J. Anim. Physiol. Anim. Nutr. 70: 82.

Lemerle, C. and Goddard, M. E. 1986. Assessment of heat stress in dairy cattle in Papu New Guineam. Anim. Health Prod. 18: 232-242.

Lippke, H. 1975. Digestibility and volatile fatty acids in steers and weathers at 21 and 32 (^{O}C) ambient temperatures. J. Dairy Sci. 58: 1860.

Lough, D. S., Beede, D. L. and Wilcox, C. J. 1990. Effects of feed intake and thermal stress on mammary blood flow and other physiological measurements in lactating dairy cows. J. Dairy. Sci. 73: 325-332.

Lu, C.D. 1989. Effects of heat stress on goat production. Small Ruminant Res. 2: 151–162.

Mallonee, P. G., Beede, D. K., Collier, R. J. and Wilcox, C. J. 1985. Production and physiological responses of dairy cows to varying dietary potassium during heat stress. J. Dairy Sci. 68: 1479.

Marai I. F. M., Habeeb, A., Daader, A. H. and Yousef, H. M. 1997. Effects of diet supplementation and body cooling on Friesian calves reared in high ambient temperatures in the eastern desert of Egypt. Trop. Anim. Health Prod. 29: 201-208.

McDowell, R. E. and Weldy, J. R. 1967. Water exchange of cattle under heat stress. Biometerology. Part 1. 2: 414 – 424.

McDowell, R. E., Mody, E. G., VanSoest, P. J., Lehman, R. P. and Ford, G. L. 1969. Effect of heat stress on energy and water utilization lactating cow. J. Dairy Sci. 52: 188 – 194.

McDowell, R. E. 1972. Improvement of livestock production in warm cilimates. W. H. Freeman and Co., San Francisco, California .

Merchen, N. R. 1998. Digestion, absorption and excretion in ruminants. The ruminant animal: digestive physiology and nutrition. D.C. Church, ed. pp. 172-201. Englewood Cliffs, NJ: Prentic-Hall.

Miaron, J. O. and Christopherson, R. J. 1992. Effect of prolonged thermal exposure on heat production, reticular motility, rumen-fluid and particulate passage rate constants and apparent digestibility in steers. Can. J. Anim. Sci. 72: 809-819.

Mohamed, M. E. and Johnson, H. D. 1985. Effect of growth hormone on milk yields and related physiological function of Holstein cows exposed to heat stress. J. Dairy Sci. 68: 1123–1133.

Monteith, J. L. and Mount , L. E. 1973. Heat loss from animals and man assessment and control. pp. 205 - 231. Proceedings of the twentieth easter school in agricultural science university of Nottingham. Butterworths, London.

Murphy, J. J. and Morgan, D. J. 1983. Effect of inclusion of protected and unporotected tallow in the supplement on the performance of lactating dairy cows. J. Anim. Prod. 37: 203–210.

National Research Council. 1981. Effect of environment on nutrient requirements of domestic animals. National Academy Press, Washington, DC.

National Research Council. 1989. Nutrient requirements of dairy cattle. 6th rev. ed. Natl. Acad. Sci. Washington, DC.

NOAA. 1976. Livestock hot weather stress. U. S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service Central Region. Regional Operations Manual Letter. 31-76.

Ominski, K. H., Kennedy, A. D., Wittenberg, K. M. and Moshtaghi Nia, S. A. 2001. Physiological and production responses to feeding schedule in lactating dairy cows exposed to short-term, moderate heat stress. J. Dairy. Sci. 85: 730-737.

Owens F. N. and Hanson F. C. 1992. Symposium: external and internal markers, external and internal markers for appraising site and extent of digestion in ruminants. J. Dairy Sci. 75 (9). 2605-2617.

Perez, J. F., Balcells, J., Guada, J. A. and Castrillo, C. 1997. Contribution of dietary nitrogen and purine bases to duodenal digesta: comparison of duodenal and polyester-bag measurements. Br. Soc. Anim. Sci. 65: 237–245.

Prasanpanich, S., Sukpituksakul, P., Tudsri, S., Mikled, C., Thwaites, C. J. and Vajrabukka, C. 2002. Milk production and eating patterns of lactating cows under grazing and indoor feeding conditions in central Thailand. Tropical Grasslands. 36: 107–115.

Purwanto, B. P., Abo, Y., Sakamoto, R., Furumoto, F. and Yamamoto, S. 1990. Diurnal patterns of heat production and heart rate under thermoneutral conditions in Holstein Friesian cows differing in milk production. J. Agric. Sci. (Camb.) 114: 139 -142.

Ravagnolo, O., Mistzal, I. and G. Hoogenboom. 2000. Genetic component of heat stress in cattle, development of a heat index function. J. Dairy Sci. 83: 2120-2125.

Robertshaw, D. 1985. Heat lost of cattle. In. Yousef, M. K. (Ed.). Stress physiology in livestock, vol.1. pp. 55 – 56. CRC. Press, Boca Raton, Florida.

Rodriguez, L. W., Mekonnen, G., Wilcox, C.J., Martin, F. G. and Krienk, W. A. 1985. Effects of relative humidity, maximum and minimum temperature, pregnancy and stage of lactation on milk composition and yield. J. Dairy Sci. 68: 973–978.

Seath, D. M. and Miller, G. D. 1948. Effect of water sprinkling with and without air movement on cooling dairy cows. J. Dairy Sci. 5: 361-366.

Schneider, P. L., Beede, D. K. and Wilcox, C. J. 1986. Responses of lactating cows to dietary sodium source and potassium quality during heat stress. J. Dairy Sci. 69: 99–110.

Shearer, J. K. and Beed, D. K. 1990. Thermoregulation and physiological response of dairy cattle in hot weather. Agri-practice. No. 5. 11: 1-7.

Shingfield, K. J. and Offer, N. W. 1998. Evaluation of milk allantoin excretion as an index of microbial proteins supply in lactating dairy cows. J. Anim. Sci. 67: 371-385.

Sibanda, S., Topps, J.H., Storm, E. and Orskov, E.R. 1982. The excretion of allantoin by ruminants in relation to protein entering the abomasums. Proc. Nutr. Soc. 41: 75.

Silanikove, N. 1987. Effect of imposed reduction in energy intake on resting and fasting heat production in the black Bedouin goat. Nutr. Rep. Int. 35: 625-731.

Silanikove, N. and Tadmore, A. 1989. Rumen volume, saliva flow rate and systemic fluid homeostasis in dehydrated cattle. Am. J. Physiol. 256: 809-815.

Silanikove, N. 1992. Effect of water scarcity and hot environment on appetite and digestion in ruminants: a review. Livest. Prod Sci. 30: 175-194.

Silanikove, N. 2000. Effects of heat stress on the welfare of extensively managed domestic ruminants. Livest. Prod. Sci. 67: 1-18.

Smith, A. J. 1984. Effects of warm climates on milk yield and composition, In Smith, A. J. Milk production in developing countrics. pp. 167–181. Center of tropical Scotland, Scotland.

Smith, A. J. and Matthewman, R. W. 1986. Aspects of physiology and metabolism of dairy cows kept at high ambient temperature dissertation review I. Trop. 18: 248 – 253.

Stowell, R.R. 2000. Heat stress relief and supplemental cooling. In: Dairy housing and Equipment Systems Conf. Proc. Publ. N0 129 of the natural Resource, Agriculture, and Engineering Service (NRAES). Agricultural and Biological Engineering Department, Cornell University, Ithaca, NY.

Strickland, J. T., Bucklin, R. A., Nordstedt, R. A., Beede, D. K., and Bray, D. R. 1989. Sprinkler and fan cooling system for dairy cows in hot humid climates. Appl. Eng. Agric. 5: 231-236.

Thaccher, W. W. and Collier, R. J. 1986. Effects of climate on bovine reproduction. In: Marrow, D. A. Current Therapy in Theirogenology 2. pp. 301 – 309. W. B. Saunders. Philadelphia.

Timmermans, S. J., Johnson, L. M., Harrison, J. H. and Davisdson, D. 2000. Estimaion of the flow of microbial nitrogen to the duodenum using milk uric acid or allantoin. J. Dairy Sci. 67: 723-728.

Titgemeyer, E. C. 1997. Design and interpretation of nutrient digestion studies. J. Anim. Sci. 75: 2235-2247.

Topps, J.H. and Elliott, R.C. 1965. Relationship between concentrations of ruminal nucleic acids and excretion of purine derivatives by sheep. Nature. 205: 498-499.

Valadares, R. F. D., Broderick, G. A., Valadares Filho, S. C. and Clayton, M. K. 1999. Effect of replacing alfalfa silage with high moisture corn on ruminal protein synthesis estimated from excretion of total purine derivatives. J. Dairy Sci. 82: 2686-2696.

Van Soest, P. J. 1982. Limitations of ruminants. In: Nutritional Ecology of the Ruminant. pp. 325–344. O and B Books, Inc., Corvallis, OR.

Warren, W. P., Martz, F. A., Asay, K. H., Hiderbrand, E. S., Payne, C. G. and Vogt, J. R. 1974. Digestibility and rate of passage by steers fed tall fescue alfalfa and orchard grass in 18° and 32° C ambient temperature. J. Anim. Sci. 39: 93-96.

Wenham, G. 1979. Effects of cannulation on the intestinal motility. Ann. Rech. Vet. 10: 157-159.

West, J. W. 1994. Interactions of energy and bovine somatotropin with heat stress. J. Dairy. Sci. 77: 2091-2102.

West, J. W. 1999. Nutritional strategies for managing the heat – sressed dairy cow. J. Anim. Sci. 77: 21–35.

West, J. W., Hill, G. M., Fernandez, J. m., Mandebvu, P. and Mullinix, B. G. 1999. Effects of Dietary fiber on intake, milk yield and digestion by lactating dairy cows during or hot humid weather. J. Dairy Sci. 82: 2455–2465.

Whitelaw, F. G., Hyldgaard-Jensen, J., Reid, R. S. and Kay, M. G. 1970. Volatile fatty acid production in the rumen of cattle given all-concentration diet. Br. J. Nutr. 24: 179-195.

Williams, C. H., David, D. J. and Iismaa, O. 1962. The determination of chromic oxide in feces samples by atomic absorption spectrophotometry. J. Agric. Sci. (Camb.) 59: 381-385.

Wordford, S. T., Murphy, M. R. and Davis, C. L. 1984. Water dynamics of dairy cattle as affected by initiation of lactation and feed intake. J. Dairy Sci. 67: 2336–2343.

Yeck, R. G. and Stewart, R. E. 1959. A ten year summary of the psyhroenrugetic laboratory dairy cattle research at the university of Missuri Transactions of ASAE. 2(1): 71.

Young, E. G. and C. F. Conway. 1942. On the estimation of allantoin by the Rimini-Schryver reaction. J. Biol. Chem. 142: 839-852.

Yousef, M. K. 1985. Stress Physiology in Livestock (vol 2). CRC. Press Inc., Boca Raton, Florida. U.S.A.

Yousri, R. M., Abou Akkada, A. R. and Abou Raya, A. K. 1977. Rumen activity and blood urea of sheep as affected by climatic conditions. World Rev. Anim. Prod. 23: 51–56.

BIOGRAPHY

Mister Virat Choktananukul was born on February 20, 1982 in Ratchaburi, Thailand. He graduated from the Faculty Animal Production Technology, Institute of Agriculture Technology, Suranaree University of Technology. He received the Bachelor degree of Science of the Agricultural Technology in 2002. He admitted with the degree of Master of Science, Department of Animal Husbandry, Faculty of Veterinary Science, Chulalongkorn Universerity in 2003.